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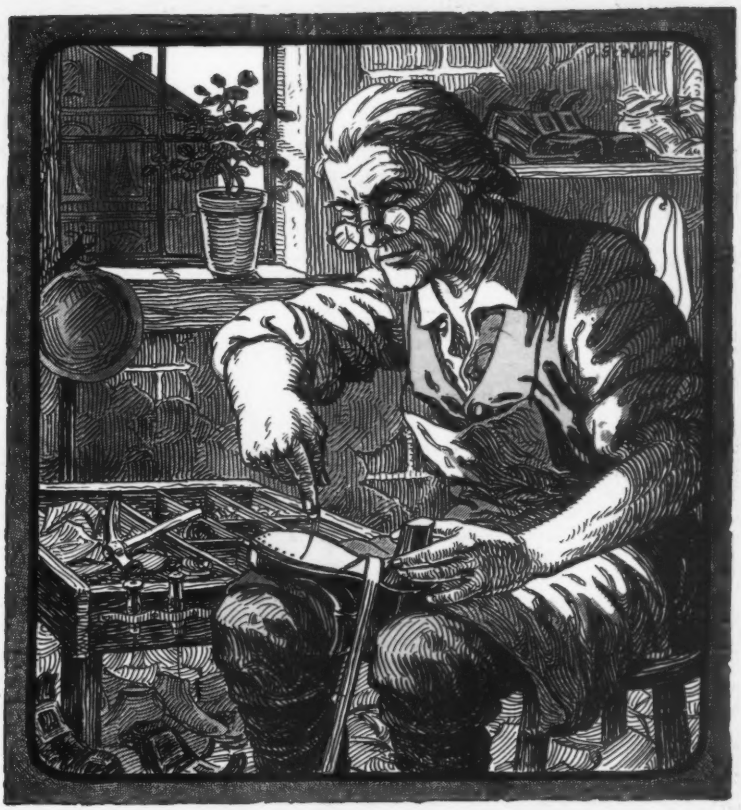

AUGUST ~ 1929

The BRUCE PUBLISHING COMPANY
NEW YORK MILWAUKEE CHICAGO

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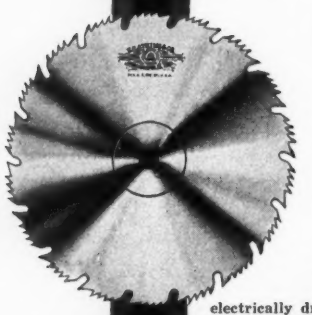

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The beginning of school in September may find you in new surroundings. Do not fail to inform the INDUSTRIAL-ARTS MAGAZINE of your change of address, nor of your change of school. The MAGAZINE is deeply interested in the career of its subscribers. Send us your personal notes.

THIS MONTH'S ISSUE

This issue of the INDUSTRIAL-ARTS MAGAZINE contains 51 school utilities. Each one of these has been found useful by someone.

We present them to you as they were submitted to us, but you may probably be able to improve on them. If they assist you in your work, or if they activate your own inventive ability, the publishers of the MAGAZINE will feel highly gratified.

THIS MONTH'S COVER

An interesting comment about this month's cover may be found on page 322 of this issue.

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(The articles contained in the Magazine are regularly indexed in "The Reader's Guide to Periodical Literature," "Education Index," and "Current Magazine Contents."

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SENECA FALLS NEW YORK

THE INDUSTRIAL-ARTS MAGAZINE

Volume XVIII AUGUST, 1929 No. 8

Graphic Analysis of Finishing for Instructional Use in Wood-Finishing and Woodworking Classes

Clyde A. Bowman, Dean of School of Industrial Education; Paul C. Nelson, Teacher of Wood Finishing and Woodwork, Stout Institute, Menomonie, Wis.

(For Fig. 1 See Supplement No. 144)

THIS analysis of finishing, while recognizing the broad scope of the field, has been restricted to the finishing of wood and wood substitutes. In planning it, recognition of the fact has been made that in junior high, senior high, and vocational schools, finishing is usually a unit operated in conjunction with other work, usually woodwork. The graphic analysis itself is designed for use by the teacher in planning his instructional material. This material may be used as a basis for a separate course in wood finishing, or it may be used from time to time in subdivisions of other courses. It may also be used as a definite instructional device, to be studied by the pupil to bring about an orientation of his acquisitions in the work in finishing.

Figure 1, entitled "An Analysis Chart for Use in Recording Selection of Content in Finishing for Instructional Use" has in it recognition of the several possible uses of the analysis. This recognition is evident in the large divisions which have been used in sorting and classifying the total content. The groupings of subdivisions under these large headings have also been distributed to facilitate accurate checking, for recording purposes, of selected instructional material in the various phases of finishing. Figure 1, in the form presented in this article, is planned to be regarded as what might be called a "master chart." It will change as the occupation changes. As new locations in industry develop these will be added to the master chart. As new constructions or products appear on which certain finishing operations are used, they will be added in the appropriate location under that heading. As new materials are developed for finishing they will be added to the analysis chart. As old materials go into disuse and become virtually obsolete they will be taken out of the analysis. As new processes, new operations, and new sequences of work are developed, they will be added under the heading "Basic Things Done." As old processes go into the discard, they will be eliminated. The typical changes which have been suggested in the foregoing naturally have an immediate effect on "basic tools and supplies." As these changes take place the new tools and supplies would be entered according to their classification. As old tools and supplies are forced into the discard they will be taken out of the analysis.

In the various industrial occupations which are represented in our program of industrial education, finishing is changing as rapidly as any, and more rapidly than many. This constant shifting in the occupational content increases the instructional value of the graphic analysis. The completeness and at the same time the extreme accessibility in the graphic analysis makes it possible to keep pace with changes in the occupation and to make an oriented record of these changes. The significance of this orientation through the graphic analysis is of value from the instructional standpoint in that when the new element is recognized it is recorded in the analysis in such a way as to show its effect in the occupation. By entering the new item in a classified way, its replacement significance is immediately apparent. If it is likely to replace some old tool or supply or some previous process or some previous material, etc., this fact is easily discernible in the chart.

Figure 2 is a reproduction of the lower part of Figure 1. Figure 1 is designed to be duplicated in quantity and used in planning specific portions of instructional material. This instructional material may have specific assignments of work listed under the heading "Job Specifications." These assignments of work may be listed in the sequence in which they will be given. This may be done in either case, whether the work is to be handled in a separate unit or woven in with instruction in woodwork.

Types of materials and methods of application in wood finishing have undergone radical changes in recent years. Not long ago, a considerable portion of the coloring of wood was done by fuming, a process of exposing certain woods to strong ammonia fumes. Today many of the so-called fumed finishes are made by applying certain dissolved chemicals on the wood. The same shade is also produced by the use of special wood dyes. These latter methods have advantages over the original fuming. First, the elimination of the fuming room or box and other special equipment; second, a material shortening of the time required for staining an article; and third, the fact that by the latter process, woods with little or no tannic-acid content may easily be given a fumed finish. Birch is typical of this class of woods.

The most outstanding new development in wood-finishing materials is probably that of the pyroxylin lacquer. The pyroxylin lacquer is largely a solution of nitrocellulose. During the few years since its introduction in general wood finishing this new product itself has undergone rather radical changes. It is no longer a pure nitrocellulose solution, but is what might be called a combination lacquer. It is obtainable in clear lacquer to take the place of varnish and other transparent surface finishing materials. Lacquer enamel, a pigmented lacquer, is used extensively in place of the older oil and varnish enamels, and certain special lacquer preparations are used for bronzing liquids and for producing the attractive, flaky-appearing surfaces called "hilo finishing."

Pyroxylin lacquer is a very desirable finishing material. Its chief advantage is probably its extremely rapid drying and hardening. This quality enables the manufacturer to apply two or three coats of lacquer on furniture or other woodwork and to crate the pieces for shipment, without harm to the finish, three or four hours after the first coat of lacquer was applied. This very rapid drying was a decided disadvantage in another respect; it was practically impossible to apply the lacquer evenly with a brush. A new method of application became a real necessity, a need which appears to be the cause for the rapid development and the rather universal use of the air sprayer. The air sprayer, as it is now developed, handles the difficult application of lacquer with ease, and it has been found that it applies nearly all other liquid finishing materials equally well. In fact, the bulk of all staining, shellacking, varnishing, and painting is now done by the air sprayer.

The spraying method of application has, in turn, brought new and changed methods for guarding the health of the workers and for protecting the property of the factory owners. State and national safety codes specify types, sizes, and constructions of booths or rooms for spraying operations. They specify capacity and installations of exhaust fans in these booths or rooms. It has been found that the finely vaporized finishing liquids blown from the air sprayer constitute a very great fire hazard. These vapors, some of them poisonous, are a definite menace to the health of the operators. For these reasons it is necessary to confine the vapors to the smallest practicable space, and to have them carried away by the exhaust system as rapidly as possible. Figure 3 shows an all-steel spraying booth. The steel back, separating the booth proper from the exhaust chamber, is made in a series of baffle plates. These distribute the air suction quite evenly over the entire surface. The exhaust pipe and the motor driving the fan are shown above the spraying booth. Electric connections and fixtures must be entirely outside of the booth.

Within the past few years a number of hand-operated spray guns were placed on the market. One of these is shown in Figure 4. The work which may be done by these hand sprayers is quite limited. They fail to measure up to one outstanding modern requirement, speed. It is difficult to do the finer types of work with them. The very latest change in equipment for application is a compromise between the large expensive power sprayers and the small hand sprayers. Reputable spray-equipment manufacturers are now placing on the market small, portable, electric spraying units. These will probably include a compressor, air line, and air gun. These small spraying units will likely prove very satisfactory for the small jobbing shop and for the average school shop.

The rapid drying property of lacquer was quickly recognized by wood finishers, and it is interesting to note how this has brought about changes in the development of oil varnishes and enamels. The varnish manufacturers are now producing four-hour varnishes and enamels that will harden in three to five hours. These new varnishes and enamels work well under the brush and they seem to be fully satisfactory.

Wood-finishing liquids should be placed in an approved fireproof vault or in isolated storehouses. Small quantities of these liquids and the necessary

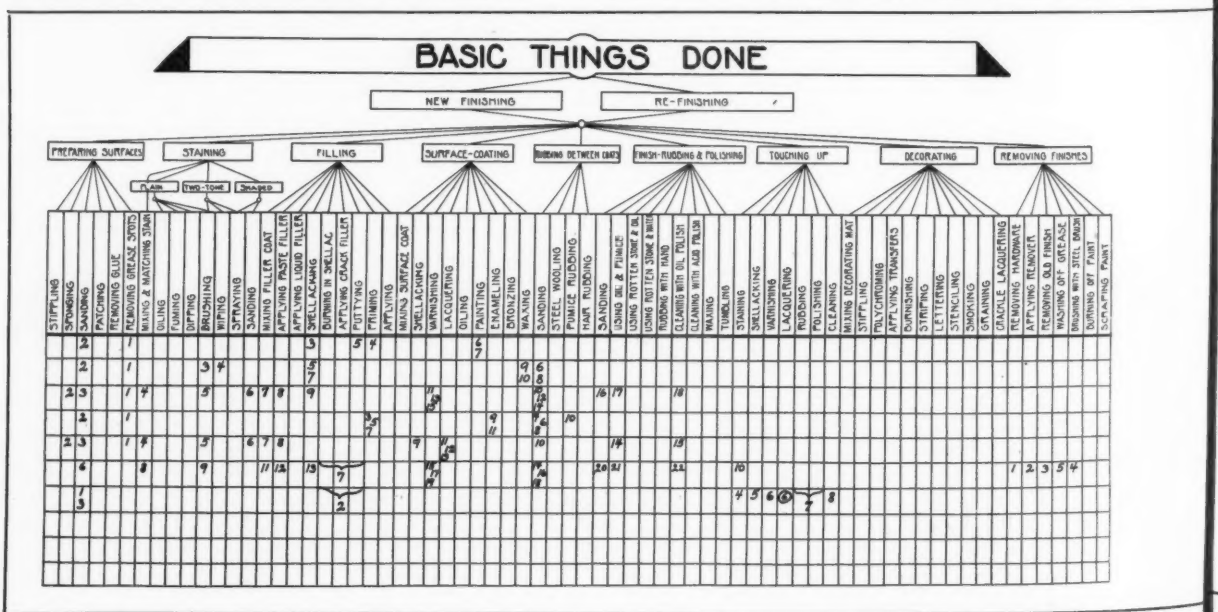


FIG. 2. METHOD OF USING THE ANALYSIS CHA

tools and supplies for a wood-finishing class may be kept in a steel cabinet as shown in Figure 5. The liquids should be handled in the original containers, or they should be poured into approved safety cans which are painted the proper color and which are labeled.

The cabinet should be of approved fire-resisting design and construction. This makes it necessary that its sides, back, and doors are made in double construction with a good air space between the outer and the inner steel plates.

One of the troublesome problems of teaching wood finishing is the care of brushes. The simple pieces of equipment shown in Figures 6 and 7 have proved quite satisfactory as an aid in taking care of brushes.

The students are taught early in the course how to clean a wood-finishing brush. Each student is assigned a stain brush, a shellac brush, and a varnish brush. The handles on these brushes are lacquered with a color designating a certain use. Yellow for varnish, red for shellac, and black for stain. Three water-sealed brush-keeping cans are painted with corresponding colored bands. These colored bands and the labels show at a glance the kind of brush for which a particular can is intended.

Each student is taught to clean his brush immediately after he is through using it. If, however, he is completing a coat of finishing, and time will not permit him to clean his brush the same day, he may place it in the proper brush-keeping can till the next day. As shown in Figure 6, the brush handles are drilled a certain distance from the tip of the brush. The pins, or hooks, in the keepers are placed about ½ inch higher to keep the bristles from touching the bottom of the can. Each inner can has a quantity of suitable brush-keeping liquid in it. The outer can has about 1 inch of water to make an air-tight seal when the cover is put in place.

The brush rack shown in Figure 7 has each place numbered to correspond to the numbers on the brush handles. Each space accommodates three average-size brushes. In this rack the brushes have good drying ventilation and they may dry to a flat shape ready for immediate use.

The projects or exercises listed under Job Specifications as I, II, III, and IV, are for the purpose of teaching how to apply and build up common, basic finishes. In the course listed in Figure 2, these finishes may be applied on panels of any convenient size. When making the selection of basic finishes to be taught, this selection may be based on local, regional, or on national trends in wood finishing.

Project I, "To apply a three-coat paint finish" gives basic experiences in priming, puttying, sealing, and in finishing an outside or inside surface with paint.

II. To make a stained and waxed finish.

In this project a study should be made of appropriate colorings for given woods. The students should learn to brush and to wipe stains. In addition, they should gain a working knowledge of applying shellac, of sanding a shellacked surface, and of polishing a surface with wax.

III. To build up a filled and varnished finish.

This teaches, in addition to some of the foregoing, kinds and compositions of fillers, breaking up and preparing a paste filler, and application and rubbing of a filler. The project includes a study of varnish and the application of several coats of varnish. It also gives experience in rubbing the varnished surface with pumice stone and water or oil.

IV. To apply an enamel finish.

The students are here taught to apply enamel undercoats, or flat paints, to sand the painted surfaces between the coats and to apply enamel. A study is made of the reasons for using flat undercoats instead of regular oil paints as a foundation for enameling. Properties of hardness and of hiding power of undercoats and enamels are compared. This comparison shows the reasons for using a rather definite procedure in building up an enamel finish.

V. To finish an assembled piece of woodwork.

The selection of this project and the finishing oper-

ADMINISTRATIVE CLASSIFICATION: 9th Grade. Mixed Group. Based on: I.Q. Classification. Different manual performance abilities.

PREVIOUS FINISHING EXPERIENCE: None

TIME ALLOTMENT: 9 Weeks. 5 Days per Week. 75 Minutes daily

TOTAL NUMBER 16

NEW OPERATIONS	PROJECTS: JOB SPECIFICATIONS	ILLUSTRATIVE MATERIAL: INDEX	RELATED INFORMATION: OCCUPATIONAL	RELATED INFORMATION: TECHNICAL	SOURCES
All	I Three-coat Paint Finish	Pigment, Oil, Thinner, Colors	Employment and working conditions. Rising from laymen and pigments. Fire hazards. Trends toward machine application. Affecting types of material. Working hazards and employment conditions.	Selection. Drying	332 383 203 87 93 99
3,4,6,7	II Stained & Waxed Finish	Stains, Paste Wax		Stain, dyes. Wax compositions	33 61 97 17 118 32 344 147 90 112 71 111 39 93
2,4,6,7,8	III Filled & Varnished Finish	Filler, Varnish, Pumice Stone		Silex fillers. Comp. of Varnishes	17 198 132 120 48 137 233 193 138
6,8,7,10					237 239 283 177
9,10,11	IV Enameled Finish	Undercoatings, Enamel		Hiding capacity of Enamel	239
9,11	V Finishing an Assembled Piece of Woodwork	Lacquer, Spray Gun, Mouth Sprayer		Sequence in Finishing	239 63 316 224
1,2,3,4, 8,9,10	VI Refinishing a Piece of Furniture	Removing Agencies, Cleaning Solutions		Selection of Removing Necessity for cleaning	247 182
5,6,7,8	VII Repairing a Marred Finish	Touching up Stocks and Supplies		Quick Repairs. Building up methods	182

ations checked under "Basic Things Done" in Figure 2 are probably typical of the finishing done in the vocational and high-school shops. It is evident, from the "New Operations" column in Figure 2, that but a very few new operations need to be learned to finish this project. If the new operations were numerous for any selected project under this job specification, it would seem advisable to add more exercises in building up basic finishes. The ideal preparation in basic finishing would be one that would eliminate entirely "New Operations" from this project. The new thing to be learned would then be confined to the selection of finishes appropriate for given projects and parts of projects, to the study of proper sequences in the selected finishes, and to the handling of the finishing materials on larger and more complex surfaces.

VI. To refinish a piece of furniture.

To learn refinishing of woodwork will probably give greater future benefit to a larger number of students than any other type of finishing taught in our schools. Old, surface-worn furniture is easily obtained for refinishing projects. Very pleasing, and often surprisingly fine changes can be made on these old pieces. A good course in furniture and general woodwork refinishing in the vocational schools could bring directly into the homes of the parents and taxpayers very creditable evidence of the teaching and of the products of these schools.

The new studies in this project pertain to types of removing agencies, chemical and mechanical, for the various types of finishes. Application of the remover and the actual removing of the old finish are learned by the students, and they receive training in washing, sanding, and preparing the surfaces for the finishing coats.

VII. To repair a marred or bruised finish.

Under this head is taught how to make a quick repair by using combinations of fast-drying materials. The students also are taught the slower but better method of carefully cleaning and sanding the bruise, and then building up the finish with successive applications of finishing materials and methods. Repolishing a dulled and slightly worn finish is taught in this unit. Projects to work on can often be obtained from the students' homes. It will generally be found necessary to do some repairing by building up in bruised spots and then repolish the entire surface or piece.

The numerical checking in Figure 2 of "Basic Things Done" indicates the basic things done in each job to be assigned and the order in which they will come in the performance of the job. By a scrutiny of this checking in terms of jobs which any given pupil has performed, a very accurate record is immediately obtainable to indicate the extent to which the pupil has participated in the "basic things done" in finishing.

The checks indicated by numbers under the basic things done serve several other purposes. In the preparation of instructional material of the several types this portion of the analysis chart is of direct assistance. In the formulation of the content in the job sheet under the heading "Procedure," the specific things done in the job are indicated in the numerical checks in the chart. This indicates immediately the order in which these steps are to be placed in this type of instruction sheet. The list of basic things done serves as an inventory of the fundamental processes or operations. Certain ones of these basic processes are sufficiently complicated to warrant the preparation of a process sheet. In the preparation of instructional material the checking system under the "basic things done" is very convenient therefore, to indicate those places in the instructional material where use is to be made of a process sheet. This is very convenient, inasmuch as instruction based on process sheets is best given when the application of the process in a real job is clearly sensed. For instance, in Project II steps Nos. 3 and 4 are "brushing and wiping stain." When these steps are reached in this project before the work on the project continues, instruction will be given, based on process sheets on staining. This use of the analysis chart clearly locates the program of instruction at all times. In the preparation of job sheets instructional importance will determine the extent to which individual steps in procedure correspond exactly with numerical checks under basic things done. In some instances instructional relationship will make it desirable to combine some of the steps into one main heading in procedure. For instance, in Project II, steps 3 and 4 will probably be listed in the procedure under staining.

In the entries in the "New Operations" column, assistance is given the teacher provided the projects are assigned to the students in the order in which they are listed in the "Job Specification" column. For instance, if Project I is given first, it is assumed that at least for the majority of the members of the class all operations in this first project are new. Then if Project II is given next, the teacher knows at a glance that basic operations or processes in Project II, Nos. 3, 4, 6, and 9, constitute the new steps in this project. New things to be learned in a project in finishing may be new processes and operations for awhile. There comes a time when there should be an assignment in which the significant new portions are largely in terms of appropriate selections and applications of basic processes previously learned.

Instructional material must always include a liberal selection of illustrative material. In the analysis chart the "illustrative material" column is indicated in the form of index notes. These index notes suggest the types of illustrative material which should be available for the projects opposite the entry in the "job specification" column. The extent to which the illustrative index material is detailed will be determined by instructional needs, by the amount of available material, and the plan of instructional organization. It should be kept in mind in the selection of illustrative material that two general uses should be represented. One use will include the material designed to assist the student in the performance of the job or project assigned. The other use of the illustrative material is that which is for the purpose of giving the student a clear understanding and appreciation of the appropriate location or orientation of the project on which he is working.

These two uses of illustrative material lead directly into two large groups of related information. Illustrative material designed to assist the student to perform the job assigned leads immediately into the related technical information. This related technical material

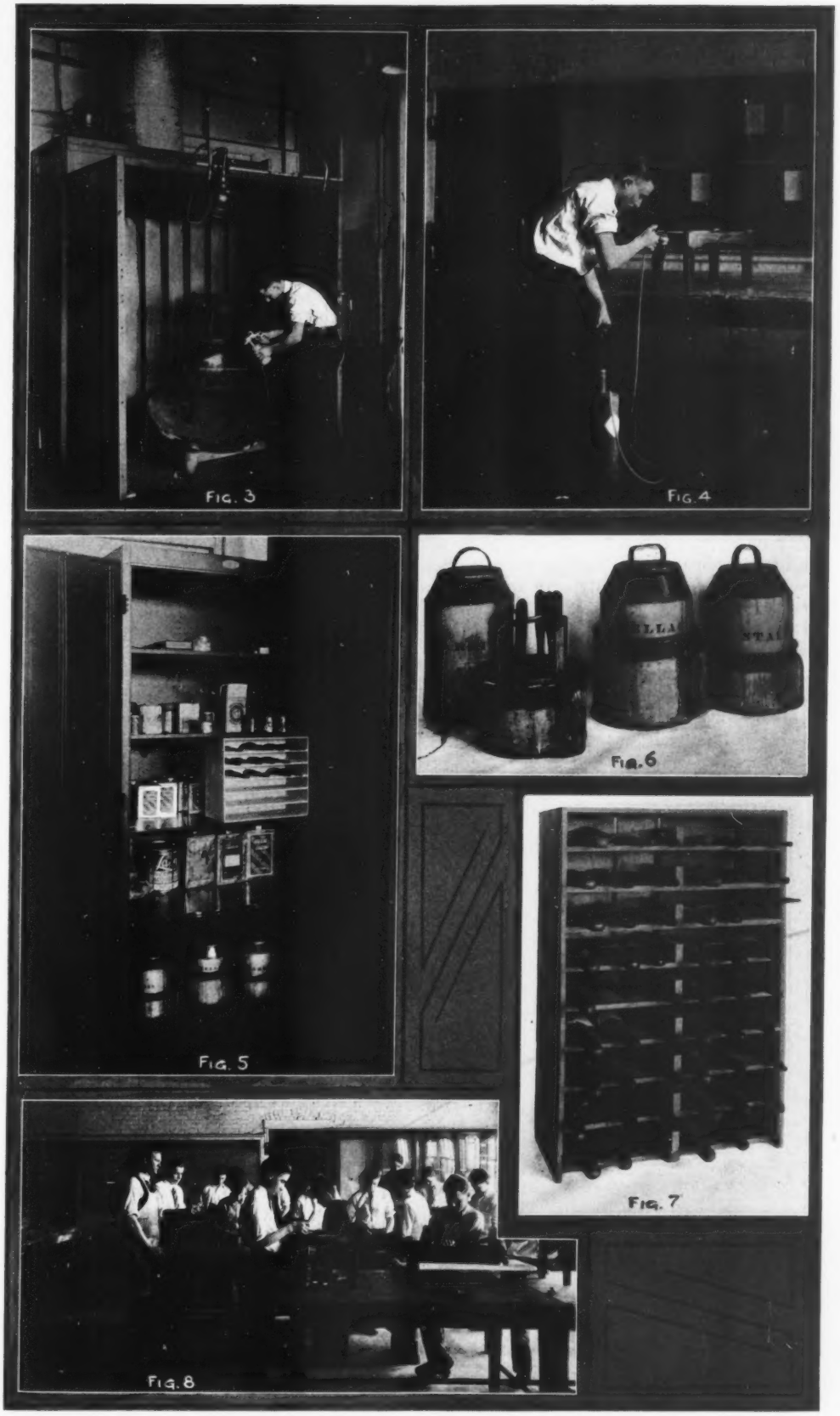


Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig. 7

Fig. 8

is of various types and is entered in the technical column in terms of significant topics. These significant topics are entered opposite the projects in which they will probably come up for first consideration. These significant topics are covered in numerous standard references. A suggestive indexing plan is included in the analysis chart under the head "Sources." For instance, on the topics, "Selection" and "Drying" as relating to Project I, which is a three-coat paint finish, there are certain significant reference readings, beginning on the pages listed opposite "Selection" and "Drying" under three of the reference-book sources. In other words, these page references to the right of the related technical column furnish immediately access to focused, related reading material on the significant topics in the related technical column. This mechanical device for indexing reference material is of decided convenience in rendering a shop library immediately accessible.

The illustrative material designed for use in giving pupils a clear understanding and appreciation of the appropriate locations of the content involved in their projects leads directly into related occupational information. This information applies more generally to the total group of projects which the students perform. In some instances studies will be made in occupational related material which deal especially with appropriate locations of specific projects. This study would include those facts relative to the occupations which are related to the particular project. In numerous instances occupational studies will be made as the course progresses, which relate to general conditions. These studies will frequently have a tangible core located in the upper portions of the analysis chart. Such studies should not be regarded as completed until consideration has been included of the outstanding changing factors in modern occupations in the finishing field. The orientation paragraph in the job sheet immediately following the job specifications is an instructional device which not only clarifies the student's appreciation of the significance of his job, but also serves as a link with the studies of related occupational information.

With the jobs to be assigned listed in the "Job Specification" column and checked at the left under the basic things done, a further accurate measure of the pupil's participation in finishing is possible through making a tally, reading up in Figure 1. The teacher and his pupils, in an instructional conference carried on through discussion and recitation, can check the materials under the classification of "Basic Materials" which have been included in the jobs performed. This checking may serve as the core of a sharply focused study of the entire range of materials used in finishing wood and wood substitutes. The graphic analysis may be used as a very tangible skeleton around which the meat of information may be built. The actual participation in finishing which the pupil has experienced is easily traceable from the "Basic Things Done" up through the subdivisions and major classifications.

The mechanical devices used in recording the various tallies and checkings made in Figure 1 may be controlled by the teacher's own preferences. In the tallying and checking which is done in connection with the recording of pupil participation, mention has already been made of the numerical checking under the "Basic Things Done." A convenient method as the discussion is carried up and recorded through Figure 1, is to use circles. The various classifications in the rectangles which have been represented in actual pupil participation are circled. Another device, if the teacher wishes to use it, will be the colored-head map pins frequently used in sales records, distributions, etc. The teacher in his thinking, as he considers the field of finishing and is selecting portions for school representation, will probably find it convenient to use Figure 1 from the top down. With the pupil the instructional episode begins with the particular pupil experiences and works upward to the large divisions. The teacher in his own selective thinking will probably deal with the large divisions logically and work down to the small divisions for instruction. The age and classification of the pupils will, of course, govern the use of the chart.

In going up further the industrial significance of finishing may be studied using the classification of "constructions or products on which applied" as a tangible basis. This study leads logically to the "locations where finishing is done." The classification of "industries or locations where finishing is done" is of material assistance in the selection of finishing content for instruction. In view of the fact that consistent recognition of the national, regional, and local distribution of occupations is necessary, this classification takes on significance due to the extent to which adults move from the communities in which they secure their education. Industrial content, which has a national distribution, is desirable where possible. Frequently content must be selected which is regional rather than national and occasionally work must be selected which is local. An expanded study of finishing, to learn the distribution, may well be linked with this level in Figure 1.

The measuring of the extent of participation in an industrial occupation is not complete until accurate information is securable as to which "basic tools and supplies" have been included in the individual's participation and which ones are still to be met. In an instructional conference or discussion the pupil participation in terms of "basic tools and supplies" may be checked and this checking, beginning with a careful inventory of tools and supplies already used, may continue and give consideration to the others under this heading.

The graphic analysis, having instructional use in finishing as its justification, is a convenient teacher aid in connection with the meeting of the different pupil purposes which may obtain when finishing instruction is being carried on. If the instruction is on an exploratory basis either in the junior high school or in a part-time, general continuation class, an accurate record of the exploratory studies may be made on the chart. Inasmuch as exploration has its full significance when properly recorded and mapped, this use of the chart will be decidedly helpful in connection with exploratory experiences. For pupils in trade-preparatory work or in extension work the chart

is of direct value. In the trade-preparatory work the preparation of the pupil must be up to date and complete. The chart may be used as an inventory check-sheet to inventory the pupil's progress. For the extension student it may be used as an inventory check-sheet to record his experience to date. This use can be continued in recording the selections of any material for him in his extension work. Inasmuch as the extension student is frequently in need of instruction in the newer developments, the ease with which changes in finishing may be incorporated in the graphic analysis makes the analysis of value from this standpoint.

In senior-high-school and vocational-school work there is a growing tendency to recognize the rapidly expanding content in finishing through the development of specific unit courses. The rate of this development and the breadth make it difficult to do justice to finishing through incidental instruction in woodworking courses. This instruction when well planned is satisfactory as far as it goes. The tendency, however, is to sacrifice instruction in woodfinishing making it incidental to the more or less successful finishing of a woodworking project.

The importance of woodfinishing in industry, in and around the home, and as a broad, live subject for study, makes it seem very desirable that this subject be included in the industrial-arts and the vocational-teaching programs as a separate and distinct unit or course.

The graphic analysis, as illustrated in Figure 1, its use as a basis for preparing a course in wood finishing (Fig. 2), and its use as a teaching help, as indicated in this article, should prove a distinct aid to the director, supervisor, or teacher who at present has charge of a separate wood-finishing course, or who contemplates giving this course a distinct place in his teaching program.

An Obligation to Boys and Girls

Laurence Parker, State Board for Vocational Education, Topeka, Kans.

THE law says that a boy or girl must remain in school until a certain age. This varies in different states. Usually they must be 16 before they can leave school. Some states have raised this limit to 18.

When attendance at school is voluntary, it puts the responsibility for the time spent upon the boy or girl or upon their parents. But when the law steps in and says that they must go to school, the responsibility is taken from their shoulders and placed on those who operate the school.

There are a number of things that can be thought of as making up this responsibility. The light and ventilation of the buildings is important. When you compel children to attend school they have a right to expect well-ventilated and well-lighted rooms in which to study.

They have a right to insist that they are not grouped in such large classes that they get little individual instruction. They have a right to insist that the teachers be well trained and up to date in their methods.

They have a right to insist that equipment with which they are to work is up to date, and well safeguarded.

The usual high-school course is largely college preparatory. It is exactly what the boy or girl needs who will go into the professions later. Such courses often have very little for the practical-minded boy or girl who must make his or her way at once after leaving school.

It is claimed to be a fact that a college education is vocational preparation for less than 10 per cent of our people. If this be true, then a college education is vocational preparation for less than 10 per cent of the boys and girls who are required to remain in school until 16 or 18. The other 90 per cent of these boys and girls have a right to insist that the time they are required by law to spend in school be applied in such a way that it will fit them for earning a livelihood when the law turns them loose to go to work.

ADULT EDUCATION

The laboring man of today needs to attend evening school in order to hold a steady job. Greater improvement in a trade adds to his self-confidence, and he will be broader-minded, happier, and a more competent worker.—*Morgan.*

A PRODUCT OF THE HOLMES HIGH SCHOOL PRINTSHOP, COVINGTON, KY. HENRY A. BREUCKER, INSTRUCTOR.

INDUSTRIAL-ARTS MAGAZINE

EDITORS

E. J. Lake *J. J. Metz* *S. J. Vaughn*

HUMAN ENGINEERING

Industry is recognizing more and more that the success of any enterprise is dependent upon the proper solution of the human problems that enter into a given undertaking. It took centuries and centuries before the world finally realized that the most valuable asset in this world is humanity itself. We can readily see that in the old pagan civilization, with its institutions of slavery, little attention was paid to the individual. One can readily picture the enormous man power that was required to build the pyramids of huge stones in a desert far removed from any place where stone might be found. One can equally well picture the ruthlessness with which this man power was handled. A draft oxen might probably be hard to replace, but a human being could be killed with impunity.

Even at this day we often hear the remark that this or that farmer cared nothing about expenses when it came to saving his livestock, but that the price of a doctor to give treatment to a sick wife or child was but grumblingly paid.

In the days before the huge trucks that now are used for delivery purposes, it was quite the proper thing that horses on delivery wagons were given one hour for dinner. But the human workers were expected to start working after gulping down their dinner within the half hour that was given them.

Now that industry is recognizing that human engineering is a science just as well as mechanical engineering or electrical engineering, it is well for the school to recognize the necessity of applying the principles of this science more and more. Just as the success of an individual enterprise is tied up with human relationships, just so is the success of the schoolroom tied up with the same relationships.

Of course, this is nothing new. Education has made great strides in applying psychology to classroom situations. Yet there are altogether too many teachers who fail to make use of this science in the treatment of their students. Too many still look upon the student as a convenient vessel into which subjects must be poured, rather than a human being whose character has to be formed. Too many teachers feel that students must be harshly directed to do certain things in a certain way without spending too much energy in telling them why these things must be done in that certain way. Too many teachers believe that the way in which they order their own lives has nothing to do with the precepts which they are trying to instill in their students.

While every teacher-training institution is placing great emphasis on its courses in psychology, probably some of those who study in these institutions need more assistance in making the direct applications of this great study to themselves and to their teaching activities in the classroom. If industry finds that it is vitally necessary to study the science of human engineering, surely educators cannot fail to do likewise.

—⁘—

TRADE SECRETS

There was a time when industrial enterprises carefully excluded strangers who wanted to visit their shops. There was great fear that these strangers might carry off some of the special processes or methods that had been developed in that particular shop. The mechanics of that day imbibed the same ideas. The workman who had invented a better method for doing a given piece of work, carefully guarded his secret for fear that someone else might profit by his experience.

Fortunately these practices are rapidly disappearing. Business and industry have found that by exchanging ideas, great gains can be made by all concerned. Hence, instead of keeping a new method secret, it is widely discussed in trade papers, and the originator of it not only receives recognition, but usually gains by having someone show him how he may still further refine the new method.

School teachers too, are apt to fall into the habit of keeping secret the teaching aids which they have successfully worked out in their classes. If one mentions, in a group of teachers, that so-and-so in his classes does a certain job in a certain why, there are usually several of the by-standers who say, "Why, I have been doing that for several years." If the man whom you mention as having invented a certain method, should happen to be enterprising enough to write it up and submit it to a professional paper, the men who claim to have made use of the method for years, are apt to feel hurt because the idea which they developed is now being credited to someone else. Yet they can blame no one but themselves for their lack of initiative. It is by exchanging ideas that we are enabled to make individual progress and to help our profession to go forward.

Of course, there are some who are timid about bringing forward their own ideas for fear of being ridiculed. This really ought not to deter anyone, because almost anything that might be mentioned has been favorably criticized by some, and unfavorably by others. If the idea has been successful in one classroom, it may be safely concluded that it will be equally successful in a great many other classrooms. It is an equally safe conjecture that many other teachers would be delighted to have the opportunity of making use of the idea. Furthermore, the very fact that one teacher receives praise and prestige because of an idea which he has submitted to a professional paper, may induce others to also submit their ideas for publication.

Now that vacation time is upon us, when at least some of the busy teachers have a little more time for contemplation, it would be an eminently professional thing for each teacher to scan over the methods that have worked out successfully during the past year and put them down on paper. The duty of helping the teaching profession grow is not confined to any single teacher or group of teachers. It is the duty of all. Professional growth can be stimulated very much by

abandoning trade secrets, and fostering a free exchange of ideas.

DECREASING ACCIDENTS

In a recent address before the Michigan Safety Congress held at Detroit, Mr. W. H. Cameron, managing director of the National Safety Council, summarized the fundamental requisites for the control of the national accident problem very ably. He states these requisites in the following manner:

1. *Belief in Safety.* This is the greatest essential of all. It involves our inherited characteristics, our philosophy of life, our every act. We must accept subconsciously the axiom that the protection of our lives from accidents is the first principle.

There must be an inner conviction that life is our most precious asset and that thinking and acting safely will safeguard and prolong our lives.

2. *Acceptance of Personal Responsibility.* Every condition of our lives might be made safe—in our homes, in our workshops, on the streets, and in public places—yet if the individual does not accept personal responsibility for the driving of his automobile, for his actions in his home and in his work place, many accidents will continue to happen.

When it is remembered that the most common and outstanding cause of all accidents is false, it becomes clear that human conduct is the basis of all safety.

3. *An Active Attitude Toward Safety.* Until 20 years ago safety was left to government laws and inspections, to the insurance companies, and to the flux of public opinion. The significance of present-day opinion is the constructive and active interest of the individual in his personal safety and his cooperation to control the general accident situation.

Our modern attitude of mind is to control the conditions of our lives. To this end everyone must be aroused to take an active interest in the safety idea. This means that educators and the children in the schools must take this active interest, as well as every pedestrian and automobilist that uses the streets and highways.

4. *Leadership.* The stamping out of disease, war, ignorance, and accidents involves leadership of the highest character. All reform has been due to concentration and organization. There must be leadership by federal, state, and municipal governmental agencies; especially by all of our educational agencies, as well as by those associations that are focusing public attention on this problem.

It must be admitted that safety is not an easy job. We all have to live it and act it. Although the accident record in America today is the highest of any country in the world, it is also true that America is 25 years ahead of any other country in understanding the implications of the accident problem.

ARE SCHOOL COSTS EXCESSIVE?

The following interesting editorial from the Addison (Mich.) Courier, was reprinted in the Hamtramck Public School Bulletin. It contains so much of interest that we reproduce it herewith.

It seems to be the fashion in certain circles to exclaim and complain vociferously concerning the high cost of schools. The statement is often made that the schools are run extravagantly and that they absorb a larger amount of public money than any other enterprise. Granting this to be true we would like to ask, "Why not?" What enterprise is of more importance to the nation's welfare than the fitting of the future rank and file as well as the future leaders of our democracy for the continuation of our American ideals and principles? What enterprise then should deserve a more hearty support than that of public education?

But we would like to correct this wide-spread erroneous conception concerning the enormous cost of schools. During the past summer an investigation was carried on in the economics department of the University of Michigan concerning school costs and economic resources. Among other things discovered in this investigation we believe the following figures should be very enlightening.

In the year 1924 the total cost of education in the United States, in both public and private schools, in elementary, high schools, and colleges amounted to $2,336,073,018. In the same year the people of the United States, according to figures compiled in the office of the Secretary of the Treasury, spent the following amounts for certain other items.

Automobiles and Accessories (exclusive of trucks)	$ 4,057,000,000.00
Cigars, Cigarets, Tobacco, Snuff, Cigar and Cigaretholders	1,847,000,000.00
Drinks (nonalcoholic); Ice Cream, Sodas, etc.	820,000,000.00
Theaters, Movies, other amusements, dues, etc.	934,000,000.00
Candy	689,000,000.00
Jewelry, Watches, etc.	453,000,000.00
Fire Arms and Shells	67,000,000.00
Pianos, Organs, Phonographs, etc.	440,000,000.00
Sporting goods and Games, Toys, Cameras, etc.	431,000,000.00
Fur Articles	333,000,000.00
Perfumes and Cosmetics	261,000,000.00
Chewing Gum	87,000,000.00
Total	$10,419,000,000.00

Whenever the American people can afford to spend over ten billions of dollars for such an array of comforts and luxuries, it certainly seems as if they can afford to spend two billions of dollars for such a vital necessity as education.

THE COMPOSITE SHOP

There are many advantages in the composite shop. It is an economy in a small place to have one man teach all lines of work. It helps the boy to become acquainted with various devices and equipment and to find himself.—*Prosser.*

THE VALUE OF EDUCATION

No matter what the vocation, an education is valuable. Bigger and better opportunities present themselves to the man with an education. Efficiency comes as a result of education.—*Eisenhour.*

Electric Wiring Frames and Booths

B. B. Burling, Boys' Technical High School, Milwaukee, Wis.

FEW schools that offer electric wiring, are not provided with some kind of frame for the purpose. A survey of over 30 such schools has revealed many of the difficulties encountered and a few very interesting solutions.

The following questions were set up to provide a common basis for the analysis of each wiring equipment.

1. What size of wiring booth is used?
2. Do the frames conform with trade practice? (Spacing of studs, size of joists, etc.)
3. What provision is made for storing short lengths of conduit, B.X., etc., in each booth?
4. What provision is made for short pupils to reach the ceiling?
5. What provision is made for a workbench in each booth?
6. What provision is made for a seat in each booth?
7. What provision is made for removing worn-out studs and joists without injuring the structure?

The second of these questions received a large majority of affirmative answers as far as the spacing of studs and joists in the construction of the booths is concerned. Whatever differences of opinion there were, seemed centered around the size of joists to be used. The use of 4-in. joists is contrary to most building codes, hence they were not generally favored for booth construction, although used in many places because of economy. In addition to this the 4-in. joist necessitates a very short conduit bend in order to properly enter the ceiling plate. This is difficult for inexperienced hands, especially if ¾-in. pipe is used. The best practice favors 2 by 8-in. joists and 2 by 4-in. studs with 16-in. centers. In place of using a one 2 by 8-in. piece, economy has suggested the use of two 2 by 4-in. pieces bolted edgewise. This permits the removal of the lower-half section of the joist whenever necessary without weakening the structure.

The answers to Questions 3, 4, 5, and 6 showed that little real consideration had been given to the points raised. In some schools the booths were not equipped with anything to facilitate the work of the pupil. All answers emphasized the necessity for better equipment. A summary of all the booth equipment used in the various schools is listed as follows:

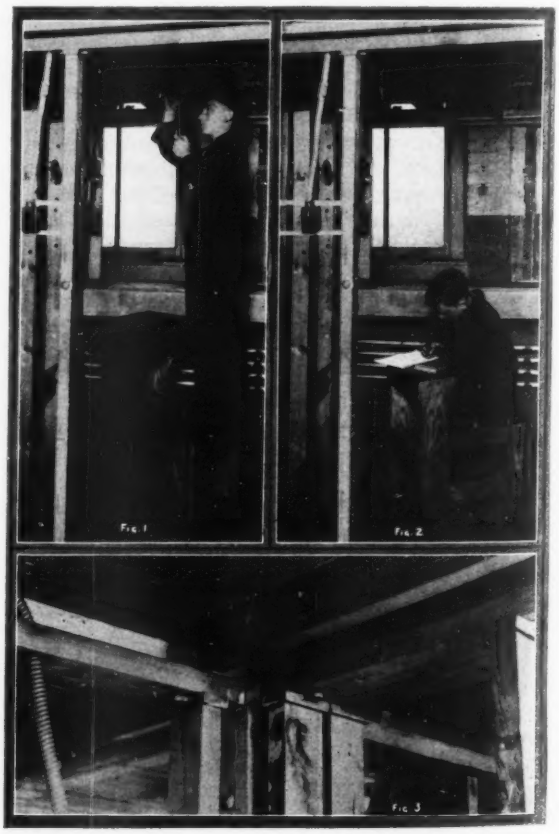
1. A storage bin for conduit, B.X., etc.
2. A bench on which to work and place tools, materials, etc.
3. A step to reach the ceiling.
4. A stool or seat.

The average size of booth was approximately 5 feet square with a ceiling height from 6 to 7 feet. This is not sufficient for many pieces of equipment. One school partially solved this problem by having a small bench and storage bin permanently located in one corner. Another school's equipment consisted of a miniature bench top with shelving below for tools, switches, etc. The most complete equipment discovered, however, consisted of a small bin for conduit, etc., and a movable combination bench-step-seat. This is claimed to entirely satisfy the requirements. This is shown in Figures 1 and 2, and has the following advantages:

1. It makes possible the use of the entire booth for wiring.
2. It occupies small floor space.
3. It is portable and may be used as a seat, step, or bench as desired.
4. It may be used as one or two steps as the height of the pupil requires.
5. It may also be used as a seat and desk top, thus avoiding the necessity of reserving other desks in the electric-wiring shop. (At a signal, all pupils can assemble with these portable desks.)

The seventh question revealed several departments where brackets, bolts, or other clamping devices were used to hold the joists and studs in place. The brackets shown in Figure 3 have been standard equipment in one school for several years. They are inexpensive and make it possible to remove a stud by unscrewing the two screws which hold the bracket in place.

In conclusion it can be said that some schools have made remarkable progress in solving these electric-shop problems. Some have even gone so far as to have



all permanent parts of the booth construction painted so as to distinguish them from the plates, studs, and joists which of necessity must be replaced occasionally. In addition to this, facilities are provided to make it unnecessary for a pupil to continually be leaving his place of work for material.

A Wood-Finishing Cabinet

Gardner G. Willard, Grand Rapids, Mich.

A PLACE for everything, and everything in its place—that is the purpose of this wood-finishing cabinet. Such a condition would be, of course, ideal, and can be realized only to a certain extent. With the construction of a cabinet, however, and a very little care, the average shop can realize a vast improvement in the economy and accessibility of wood-finishing supplies.

In any shop, and especially those in high, vocational, and normal schools, the instructor will find it well worth while to spend a little time in the construction of such a cabinet. It need not be elaborate, and can be constructed from odds and ends of materials; it need not be large, but in every case it will enable the instructor to systematically care for all finishing supplies.

The sketch shown in Figure 1 will give an idea of the general construction. A substantial wide shelf should be built about 36 in. from the floor to be used as a workbench in mixing stains, fillers, etc. Below this, a series of drawers may be built in, and below the drawers a few cupboards. Or, if desired, the space below may be left open for the storage of bulky materials. The space above the wide shelf should be filled in with suitable shelving. These shelves should be about 8 in. wide, and should be spaced so as to accommodate various sizes of cans and containers. The first shelf, if made 11½ in. high, will be just right for the 1-gal.-size varnish and round friction-top cans or pails. The second shelf should be high enough to contain a series of glass bottles, which will probably be a little higher than the first shelf. Make the third shelf 9 in. high for ½-gal. cans, and the fourth shelf 7½ in. high for ¼-gal. cans. A fifth shelf will accommodate odd-size boxes and packages, such as stain powders, etc., and if there are many of these it will be well to add a sixth shelf to take care of overflow material.

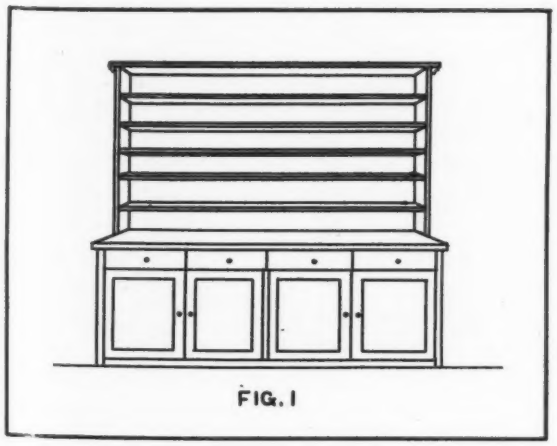


FIG. 1

Now as to the contents of the cabinet. In the space below store bulky materials, such as pumice stone, sandpaper, waste, rags, and reserve stocks of other materials. The drawers above will be handy for small brushes, spatulas, picking sticks, wood cement, etc. The main wide shelf as above stated is to be kept free in the main of materials so as to be available as a workbench. It should contain, however, a pair of scales, graduates, stirring rods, etc.

The first shelf will hold 1-gal. cans of alcohol, turpentine, naphtha, shellac, filler, varnish, oil stains, and lacquer. Note that these cans should be placed with the narrowest side to the front, so as to conserve space, this applying, of course, to all sizes of oblong cans.

The second shelf contains glass bottles for water stains. Those should be about ½- or 1-gal. capacity. Such bottles can be obtained from any drug store or physician who dispenses his own medicines. The bottles should be well washed with hot water, the correct amount of stain powder weighed out, and a thorough solution made in a separate crock or jar, and then bottled and labeled for use. Nearly all water stains will keep indefinitely if stored in glass, but remember never to keep them in tin or iron vessels for any length of time, as they are then sure to change in color. Label each bottle with the name of the color and the manufacturer's number, protecting the label with a thin coat of varnish or waterproof shellac. Stains prepared in this way will be found a great convenience, as they are ready for instant use, and mixtures of different colors are very easily and accurately made.

The third and fourth shelves, as above stated, will be used for ½- and ¼-gal. cans respectively, these being miscellaneous cans, such as bronze powders, lacquers, special varnishes, enamels, and kindred products. The fifth shelf may be used for water-soluble stain powders, these being usually packed in 1- or ½-pound cans. Unlike water stains in solution, these powders should be kept in tin, as many dyes will rot paper or cardboard containers.

So much for a general description of the cabinet. It will be noticed that dimensions and small details are lacking, as the size will vary within wide limits according to the needs of different shops. It is hoped, however, that this sketch will serve as a starting point.

The scales mentioned should be suitable to the work in hand, but usually a small pair, sensitive to one grain, and having a capacity of two to three ounces of stain powder, will suffice. Graduates should also be provided, four-, eight-, and sixteen-ounce sizes being about right. For handling the stain powder 4- or 6-inch spatulas will be needed; of course, a putty knife may be used instead. Stirring rods may be of glass, or if preferred, excellent ones may be obtained by splitting

a piece of straight-grained pine into suitable small sticks. These are to be used once and then thrown away. A supply of these will be found of great value.

For pasting labels on tin cans use shellac instead of glue. The latter is sure to let go, while shellac will hold the label securely. China marking pencils are also useful for marking on tin, but the marks are not as permanent as a shellacked label.

Insist that the covers of all friction-top cans shall be securely replaced after using, so as to effectively preserve the contents. This is especially necessary with lacquers. If, however, it is attempted to hammer down the cover while a small portion of the liquid remains in the lip of the can, the operator will receive a shower bath of paint, due to the sudden pressure. To overcome this, wipe out the lip, or place a rag over the cover of the can, and then tap it home with a hammer. The rag will catch all spatters.

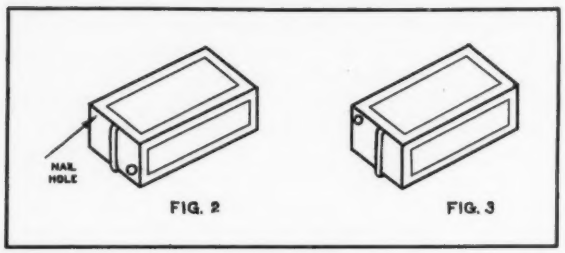


FIG. 2 FIG. 3

Another point that deserves mention is the right and wrong way of pouring from a varnish can. The common practice is shown in Figure 2, with the nozzle at the bottom. Unless a nail hole is punched at the top of the can, so as to admit air, which, of course, takes time and spoils the can, there will be a great deal of gurgling and spattering. Figure 3 shows the correct method, with the nozzle at the top of the can, so that air can easily enter as the liquid is removed. This method may look awkward, but it is actually much easier, and it is also possible to direct the stream of liquid with greater certainty.

Cans in which the material has been more than half used should usually have the contents transferred to a smaller container if it is to be kept for any length of time. This will prevent skinning and spoilage, but, of course, does not refer to liquids like turpentine, alcohol, etc.

In one drawer of the cabinet keep a card index or notebook, and enter therein all special mixtures or formulas which will invariably be made from time to time. Suppose you stumble onto a good furniture polish such as this, (and it is a good one):

1 part Linseed Oil
1 part Turpentine
1 part Water

A simpler formula would be hard to produce, and yet if you try to duplicate the mixture in six months' time without a record, ten to one you will wonder what that mixture was made of, or at best will have to guess at the proportions or materials. The card index or notebook will settle the question in short order.

Rags used with this polish, and in fact all oily and greasy rags, particularly those that have been used with linseed oil, should be burned at once, or deposited in a fireproof can at the side of the cabinet and then burned each night. Almost any stout metal container mounted on 6-in. metal legs may be used.

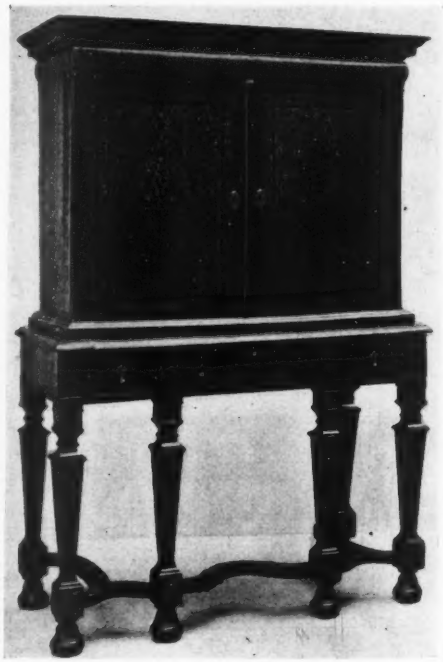
In a large shop where odds and ends of paint accumulate from time to time, it is a good plan to dump them all into a single container. This mixture can then be used for painting miscellaneous work, backs of cabinets or other work where the shade does not matter. Such a mixture, by the way, will nearly always produce some shade of gray.

A plentiful supply of old cans may usually be obtained from the boys themselves. Many homes now use the new style can openers which leave a smooth edge, and when the cans are rinsed out with hot water, they are just the thing for mixing small lots of paint, enamel, stain, etc.

If shellac is to be stored for a time, it should be transferred to glass or earthenware jugs. If kept in tin it will become curdled and discolored, whereas it will keep perfectly in glass. After shellac has stood for a short time, a clear liquid will appear at the top—in common parlance the shellac "breaks." This will occur with the best of shellacs and it need not cause any alarm, as a shake or two will result in a perfectly uniform mixture.

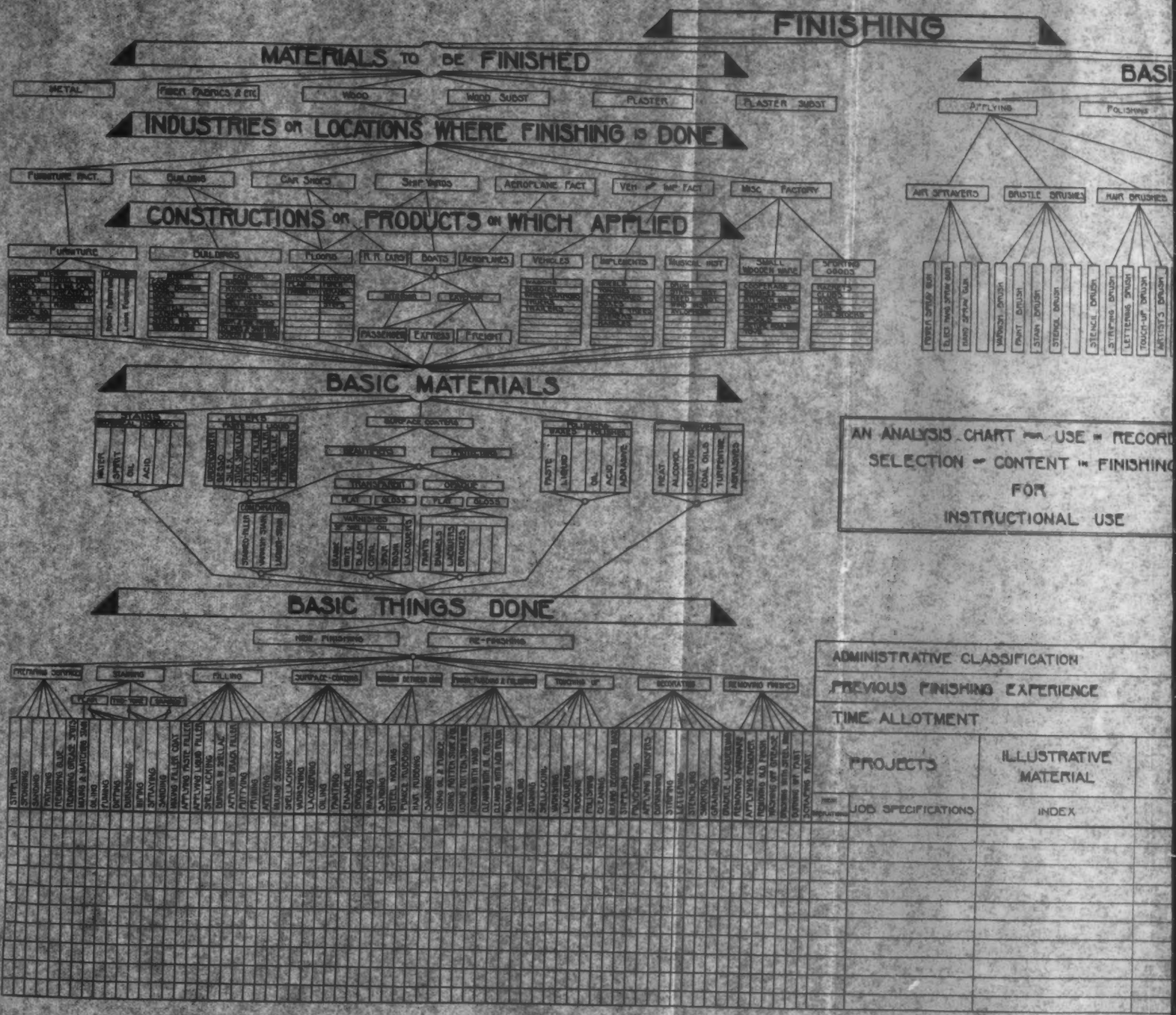
For the application of pumice stone when rubbing, use a coarse salt shaker. This will scatter the pumice evenly where wanted with no spillage. It would be well to have two or three shakers, each plainly marked with the grade of pumice it contains.

Above all, insist on "good housekeeping." Have the boys clean up all paint spots, etc., immedietely. It only takes one swipe of a rag at the time, but if neglected these spots will soon accumulate into an unsightly mess. Good housekeeping will pay, and pay well, and will be greatly simplified with a good wood-finishing cabinet.



WALNUT CABINET WITH MARQUETRY INLAY. ENGLISH 1688-1702, WILLIAM AND MARY PERIOD. Photo by Metropolitan Museum of Art, New York City.

TRACING SUPPLEMENT No. 144
THE INDUSTRIAL-ARTS MAGAZINE
AUGUST, 1929



Designed by Clyde A. Bowman and Paul C. Nelson, Minneapolis, Wis.

FIG. 1

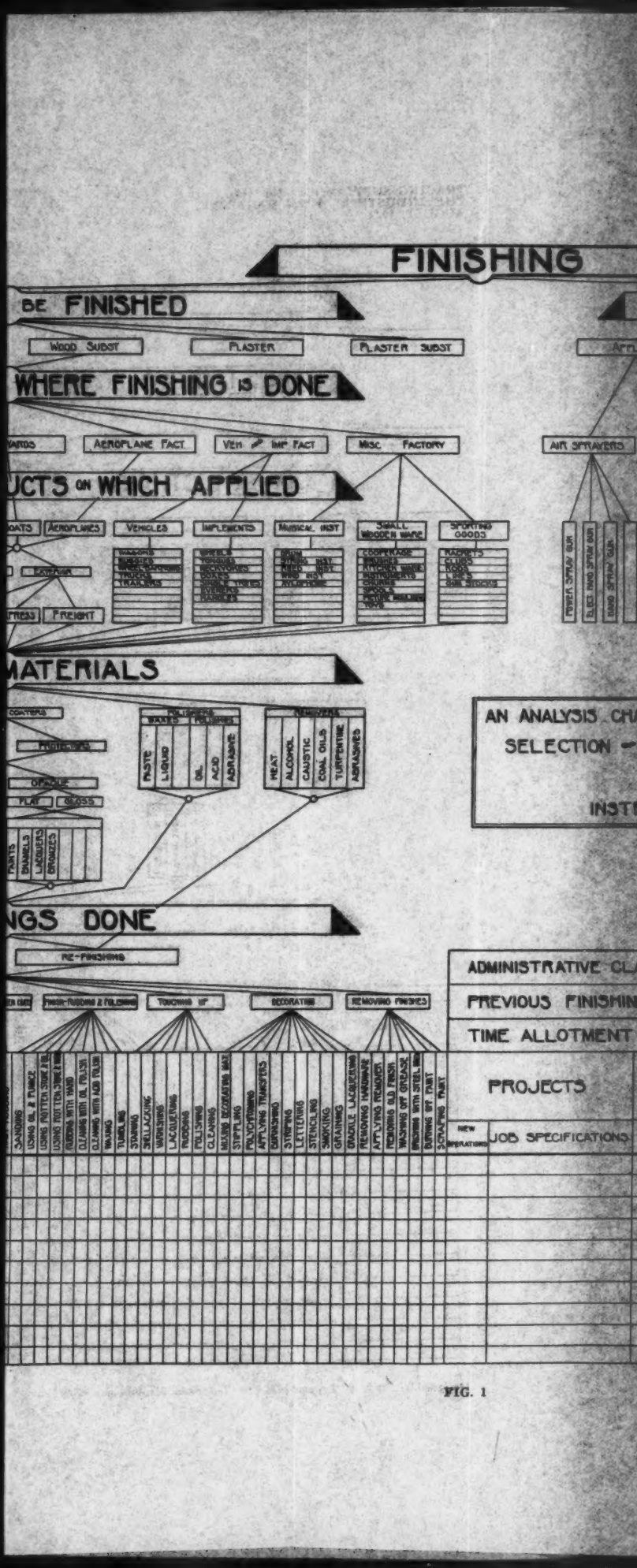

FINISHING
BE FINISHED
WOOD SUBST
PLASTER
PLASTER SUBST
WHERE FINISHING IS DONE
AERODROMES
AEROPLANE FACT.
VEH & IMP FACT
MISC. FACTORY
AIR SPRAYERS
PRODUCTS ON WHICH APPLIED
BOATS
AEROPLANES
VEHICLES
IMPLEMENTS
MUSICAL INST
SMALL WOODEN WARE
SPORTING GOODS
FREIGHT
MATERIALS
PAINTS
ENAMELS
LACQUERS
VARNISHES
FLAT
GLOSS
POLISHES
WAXES
PASTE
LIQUID
OIL
ACID
ABRASIVE
REMOVERS
HEAT
ALCOHOL
CAUSTIC
COAL OILS
TURPENTINE
ABRASIVES
AN ANALYSIS CH
SELECTION
INST
NGS DONE
RE-FINISHING
FINISH-FURNISH & POLISHING
TOUCHING UP
DECORATING
REMOVING FINISHES
ADMINISTRATIVE CL
PREVIOUS FINISHIN
TIME ALLOTMENT
PROJECTS
NEW OPERATIONS
JOB SPECIFICATIONS
SANDING
USING OIL & PUMICE
USING PATTEN STONE & OIL
USING PATTEN STONE & WATER
RUBBING WITH HAND
CLEANING WITH OIL POLISH
CLEANING WITH ACID POLISH
WAXING
TUMBLING
STAINING
SHELLACKING
VARNISHING
LACQUERING
RUBBING
POLISHING
CLEANING
MIXING DECORATING MAT
STIPPLING
POLYCHROMING
APPLYING TRANSFERS
GUMMING
STRIPING
LETTERING
STENCILING
SMOKING
GRAINING
CRADLE LACQUERING
REMOVING HARDWARE
APPLYING REMOVER
REMOVING OLD FINISH
WASHING OFF GREASE
BRUSHING WITH GASOLINE
BURNING OFF PAINT
SCRAPING PAINT

FIG. 1

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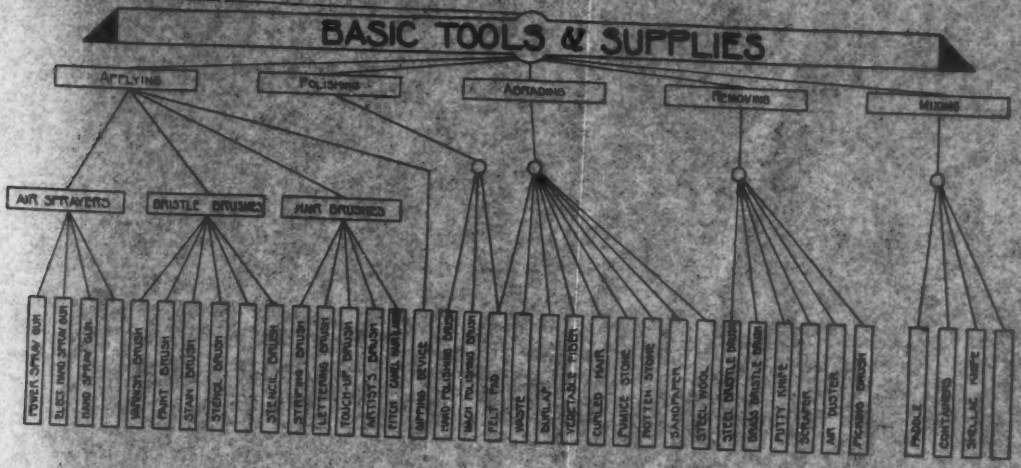
NG



NALYSIS CHART FOR USE IN RECORDING
LECTION — CONTENT IN FINISHING
FOR
INSTRUCTIONAL USE

THE STOUT INSTITUTE
MENOMONIE, WISCONSIN
ORGANIZATION — INDUSTRIAL ARTS
PLANNED BY J. W. Caldwell
DRAWN BY Gordon C. Johnson
CHECKED BY Paul C. Nelson

RATIVE CLASSIFICATION
FINISHING EXPERIENCE
LOTMENT
TOTAL NUMBER

CTS	ILLUSTRATIVE MATERIAL	RELATED INFORMATION		SOURCES							
CIFICATIONS	INDEX	TECHNICAL	OCCUPATIONAL								

UNIV. OF MICH.

For Description See Page 285, Industrial Arts Magazine, August, 1929.

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AUGUST, 1929

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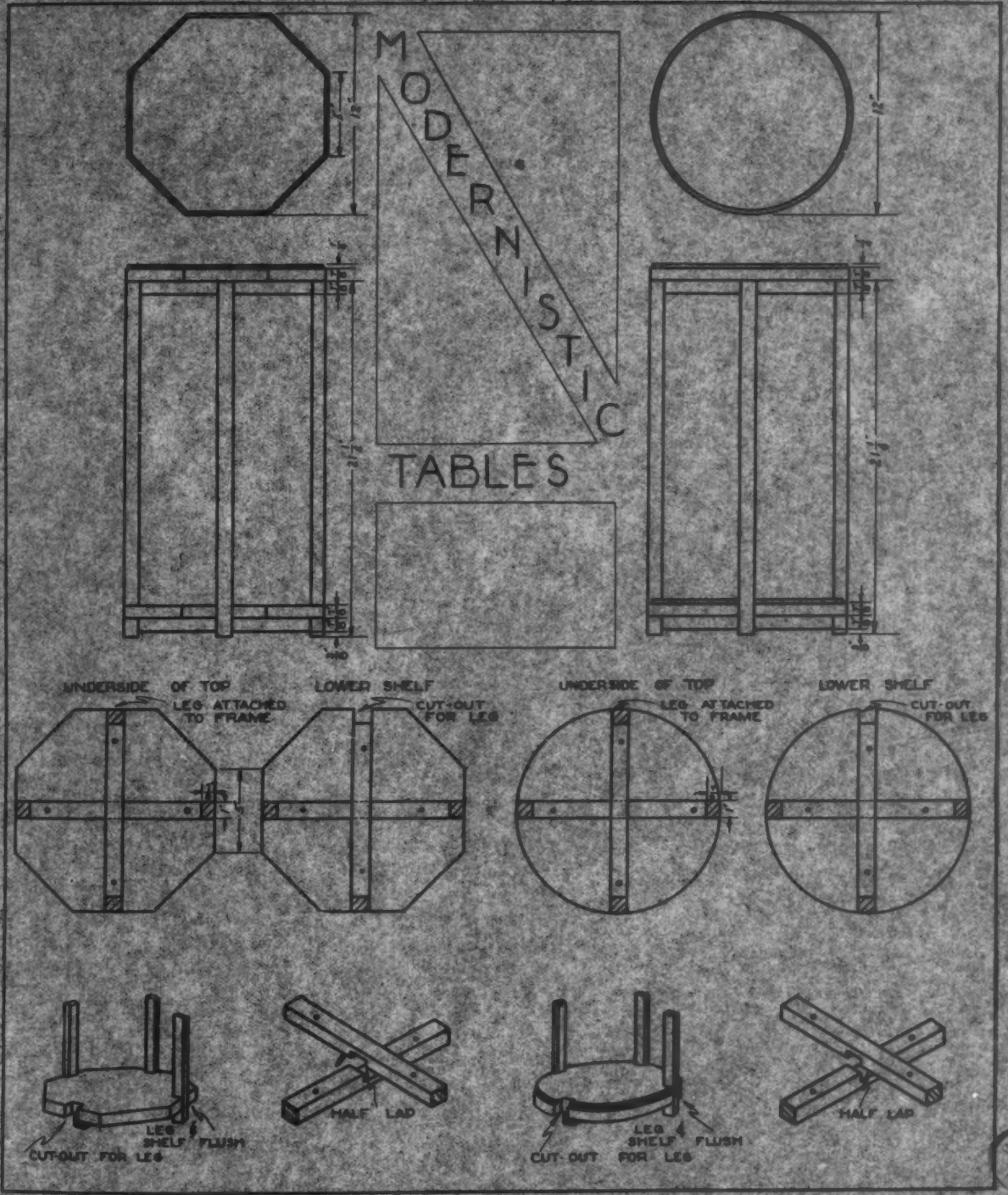
MODERNISTIC TABLES



Designed by C. A. Kunes, Los Angeles, Calif.

For Description See Page 218, Industrial-Arts Magazine, June, 1929.

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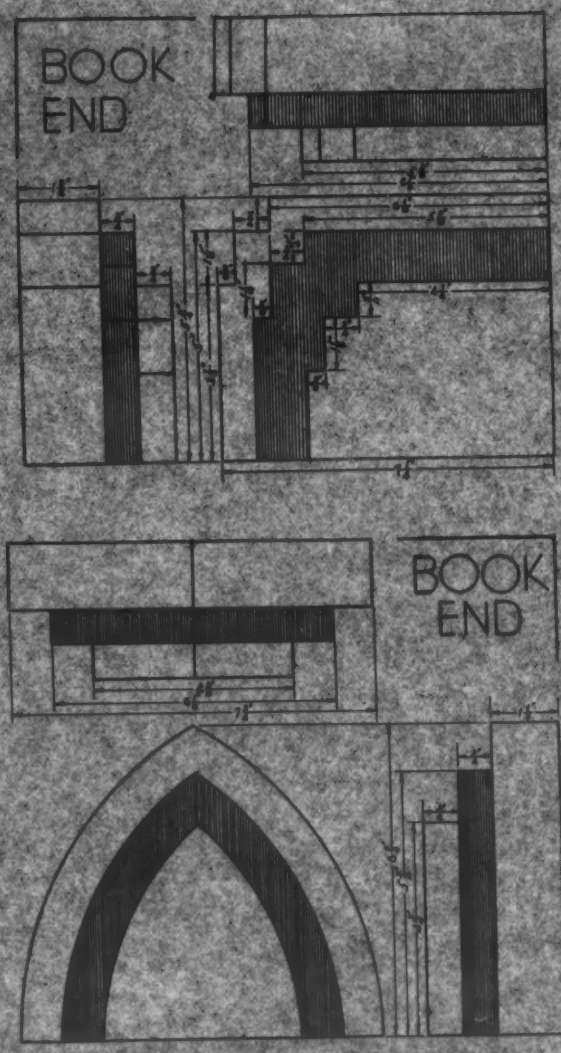

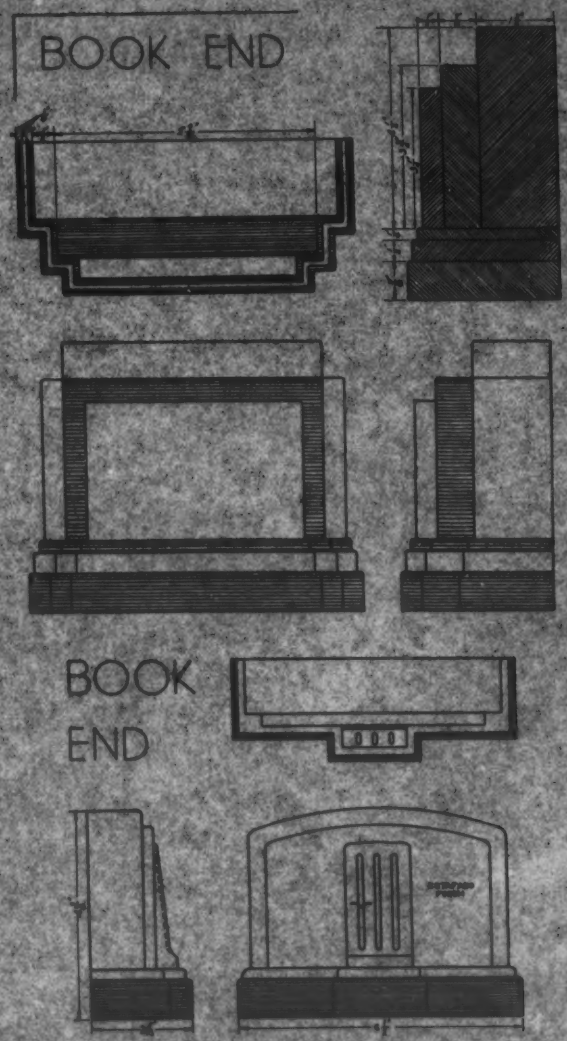

Designed by C. A. Kunou, Los Angeles, Calif.

For Description See Page 215, Industrial-Arts Magazine, June, 1929.

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PROBLEMS AND PROJECTS

This department aims to present a wide variety of class and shop projects in the Industrial Arts. Successful problems are invited and will be paid for. A brief description of constructed problems, not exceeding 250 words in length, should be accompanied by a good working drawing. The originals of the problems in drawing and design should be sent.

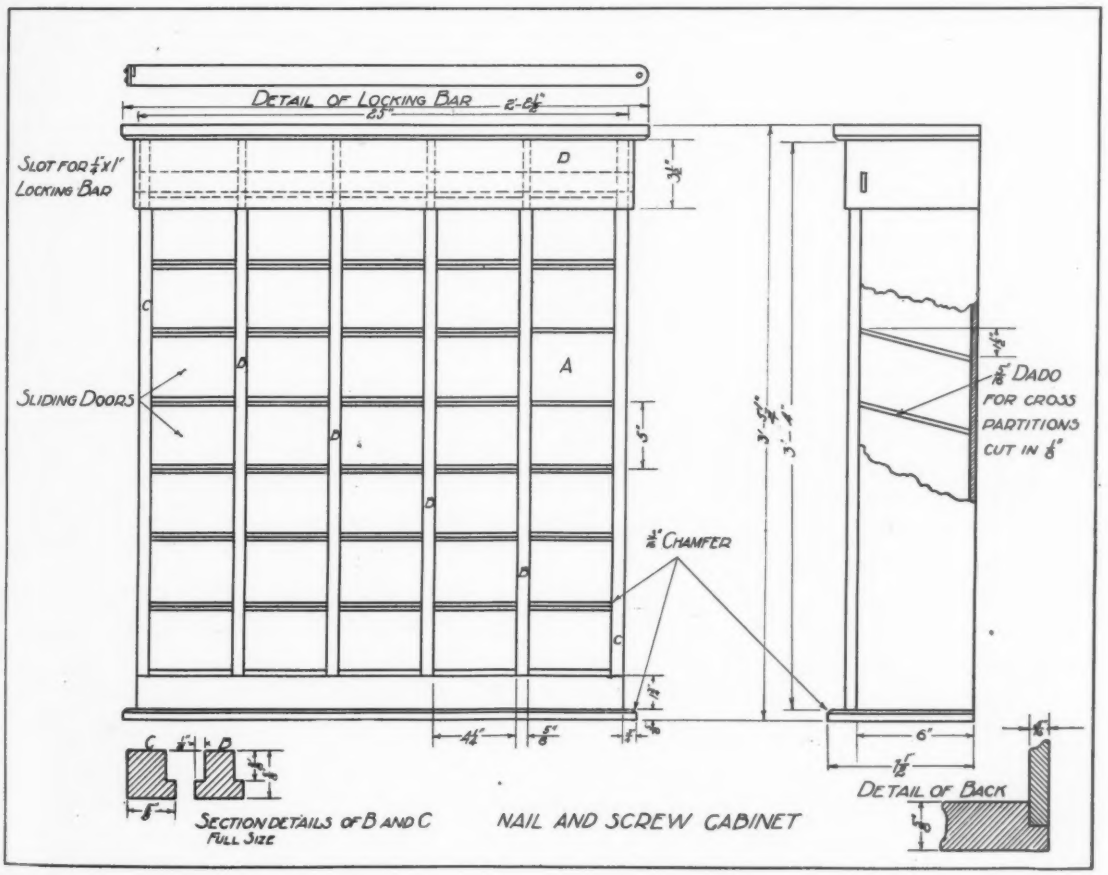
Problems in woodworking, turning, patternmaking, machine-shop practice, sheet-metal work, forging, foundry work, auto mechanics, auto electricity, electricity, architectural and mechanical drafting, printing, bookbinding, concrete work, farm mechanics, home mechanics, and other lines of industrial-arts work are desired for consideration.

NAIL AND SCREW CABINET

Ray D. Walston, Cleveland Heights, Ohio

In many schools shops there exists a real need for a cabinet in which nails, screws, tacks, small hinges, and other small hardware can be conveniently and compactly stored in an orderly fashion. Accessibility and visibility of all of the various sizes and kinds of materials stored, are important factors. The cabinet described and shown in this article was designed and made to meet just such needs as those outlined above. The size and number of compartments may be changed to meet the needs. The gravity-closing doors which slide up and down in the rabbets which are cut out of pieces B and C have at least three advantages. First, the dust of the shop is excluded; second, the doors close whether the user thinks of closing them or not; and third, the fact that the label cards, (card holders not shown in drawing) meet the eye rather than the hardware itself causes the student to look for size and style before selecting a supply, or returning surplus stock. A color scheme for labeling the cards has proved useful. The labels for all bright screws are lettered in red; the blued screw labels are in blue; all brass material is in yellow; brads are in black; and nails are in green. Labels of contrasting colors may be placed in adjacent rows; thus much can be done to eliminate the "succotash" so often found in the nail and screw cabinet. A class period spent in the discussion of school-shop hardware, and the proper way of using the cabinet will make for order and have an educational value besides.

At A, the door for that opening has been moved upward so as to uncover one compartment. The top door of this row is shown at D, which position is under the top molding. This occurs whenever any compartment is opened. The strips B and C are cut separately and rabbeted out on the saw and nailed to the vertical partitions and ends. This is done to prevent the dado in the vertical partitions from showing outside of the sliding doors. These dadoes may be cut by hand up to the door grooves if it is desired to have the vertical partitions in one piece. The extra work necessitated by this method however, seems unwarranted. The dadoes for the shelves are cut 5 in. on centers. The strips B and C are cut to run from the top of the bottom molding to the lower surface of the top



proper. The top molding, across the front, is nailed over the strips B and C in order that the doors and label holders will pass under without difficulty.

The shelves are cut in one long strip first. This strip is then beveled on both edges and then cut to the lengths required. The door material also is chamfered in one long strip and then cut to lengths.

The entire cabinet was made of ⅝-in. poplar and 5/16-in. basswood. The bill of material follows:

6 pc.	⅝ x 6 x 40	Vertical partitions and ends.
6 pc.	⅝ x ⅝ x 38¼	Strips for B and C
2 pc.	⅝ x 7½ x 26½	Top and bottom
1 pc.	⅝ x 3½ x 25½	Top molding (front)
2 pc.	⅝ x 3½ x 6⅝	Top molding (ends)
1 pc.	⅝ x 1¾ x 25	Bottom molding (front only)
42 pc.	5/16 x 5 x 4½	Doors
42 pc.	5/16 x 6 x 4½	Shelves

The back is to be made of 5/16-in. basswood.

The locking bar is made of a piece of ⅛ by 1 by 28-in. mild steel. One end is split with the hack saw for about an inch. The forks resulting from this sawing are bent in opposite directions and drilled for rivets. A 1½-in. length of stock is cut off and drilled and riveted to these forks to form a head. A ⅜-in. hole is drilled near the other end to take a padlock.

DRAWING-ROOM UTILITY DESK

H. L. Weatherby, Montgomery, Ala.

The desk illustrated herewith has been such an aid to our drawing-room equipment that I pass it on for what it may be worth to others.

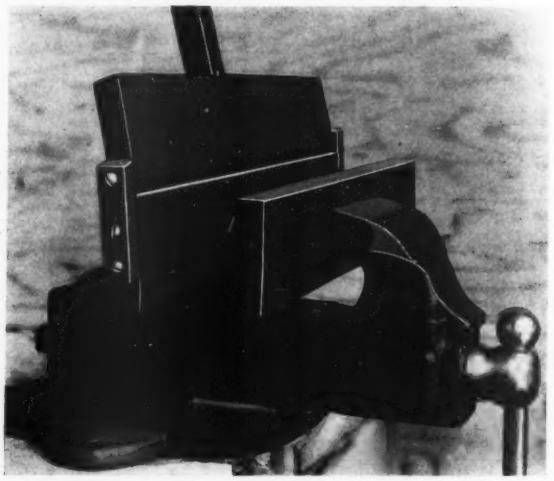
To enumerate its advantages, it has first a flat top of soft pine on which large work may be handled. It has a slanting shelf, supported by arms that may be let down, at which three boys may work comfortably. It has five drawers, 10½ by 21 in., inside dimensions to take care of the ungraded work of one or more classes. It has a lock compartment to care for 24 drawing boards with space above, also within the lock section, for drawing sets, etc. It has five partitioned sections for graded drawings or work that one wishes to keep. Lastly, it has several shelf compartments in which models, catalogs, and books may be kept.

This drawing table may not be a splendid example of the cabinetmaker's art. It is assembled largely with nails and screws, with here and there an angle brace to strengthen corners that might otherwise be weak; but it is a sturdy piece of furniture that does not need any apologies.

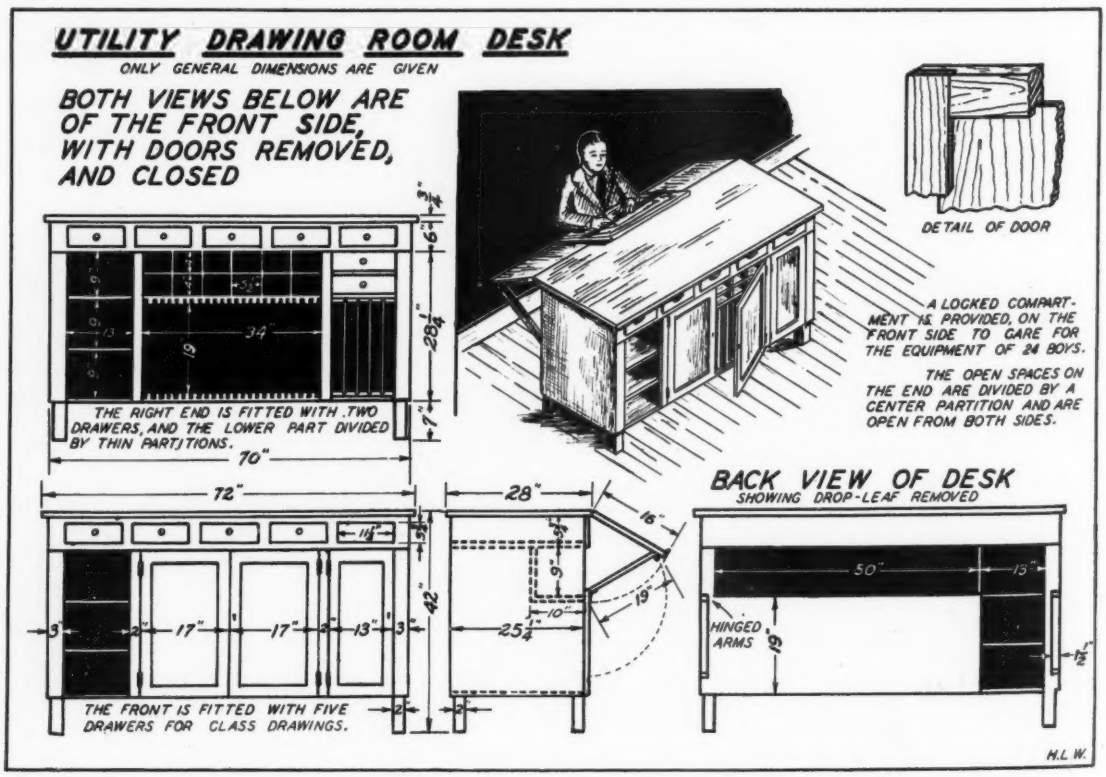
AN EASILY MADE BAR FOLDER

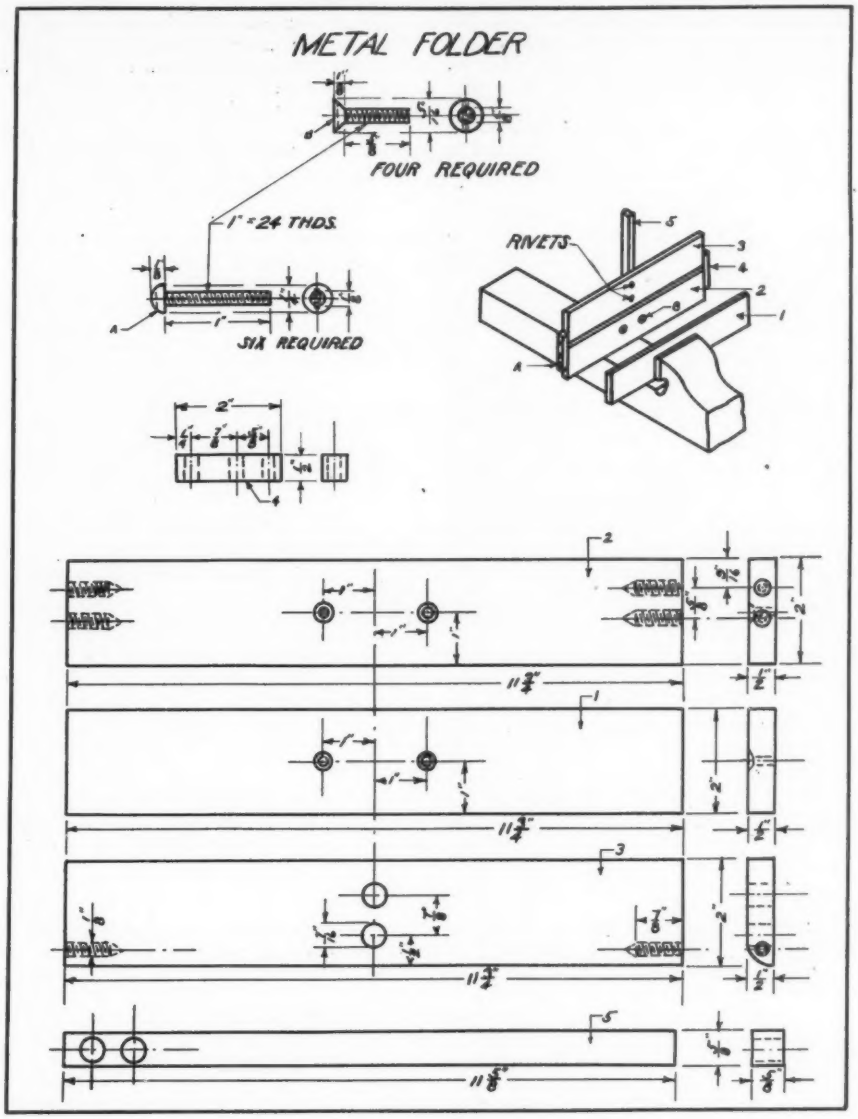
H. R. Goppert and E. Sprague, Mishawaka, Indiana

Frequently there is need to do a small amount of right-angle folding of light sheet metal in school shops where the expense of buying a bar folder would not be justified. For such purposes the rebuilt vise shown herewith is very useful, and its cost is not large, especially if there is a light machinists' vise available.



Dimensions will vary according to the purposes for which the folder is intended, but the one shown here works very well. The parts numbered 1, 2, 3, 4, and 5 in the drawing are made of cold-rolled steel of the dimensions shown. The screws shown at B in the assembly drawing should be spaced to fit the screw holes which were used to hold the hardened jaws to the


UTILITY DRAWING ROOM DESK
ONLY GENERAL DIMENSIONS ARE GIVEN
BOTH VIEWS BELOW ARE OF THE FRONT SIDE, WITH DOORS REMOVED, AND CLOSED
DETAIL OF DOOR
A LOCKED COMPARTMENT IS PROVIDED, ON THE FRONT SIDE TO CARE FOR THE EQUIPMENT OF 24 BOYS.
THE OPEN SPACES ON THE END ARE DIVIDED BY A CENTER PARTITION AND ARE OPEN FROM BOTH SIDES.
THE RIGHT END IS FITTED WITH TWO DRAWERS, AND THE LOWER PART DIVIDED BY THIN PARTITIONS.
70"
72"
28"
BACK VIEW OF DESK
SHOWING DROP-LEAF REMOVED
50"
15"
HINGED ARMS
42"
25¼"
19"
16"
THE FRONT IS FITTED WITH FIVE DRAWERS FOR CLASS DRAWINGS.
H.L.W.



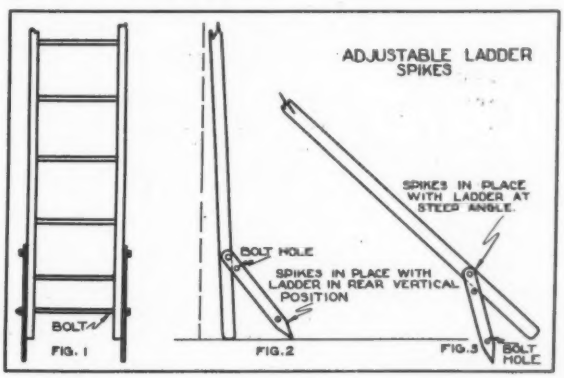
vise, if the one used was originally fitted with them. If it was not so fitted, it will be necessary to drill and tap holes in the face of the vise jaws to fit the holes as they are shown in parts 1 and 2.

In using the folder the stock to be bent is clamped between the jaws of the vise, with the line of the fold on a level with the top of the stationary bars. Then by swinging the upper or moving bar forward, the bend is made at the line determined upon. Where it is necessary to make a number of folds on parallel lines of a piece of metal, the fold nearest the top must be made first and the stock moved up for each successive one. We use the folder pictured here for bending metal parts of toasters and other projects in the electric shop, and it works very well.

ADJUSTABLE LADDER SPIKES

H. Moore, Hamilton, Ont., Canada

Instead of using solid spikes bolted to the sides of a ladder, the spikes can be made adjustable to give nonslip service under all conditions. Make two spikes out of flat steel and fasten them to the ladder sides with bolts. Next, drill a hole through both straps a few inches below the top bolt holes, and farther down drill a hole the same size through straps and ladder. Insert a long bolt with a nut on the end and the attachment is ready for use. Under normal conditions the spikes are held in line with the ladder as shown in Figure 1, but if the ladder is required for use in a near vertical position where it is liable to tip back, the long bolt is withdrawn and replaced with the spikes behind the ladder. (See Fig. 2.) In cases where the ladder is to be used at a steep angle the bolt is inserted in the top holes where it rests against the ladder sides as shown in Figure 3.



A PORTABLE CLAMP RACK

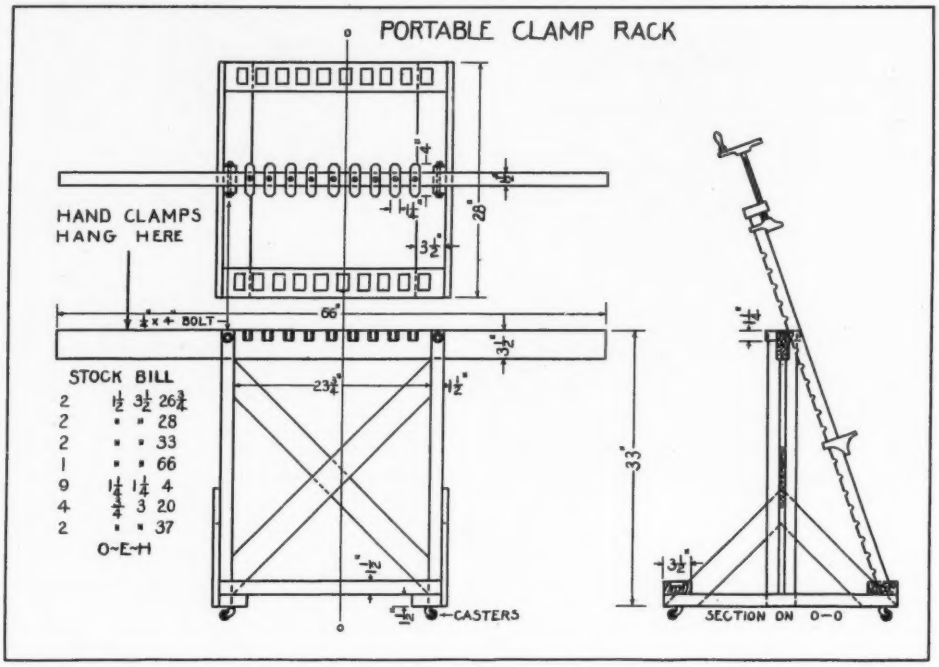
Otto E. Henkel, Longmont, Colo.

The illustration which accompanies this article shows a portable clamp rack which we are using in our shop. Since we adopted this rack there are no more clamps to carry about, nor are the clamps scattered about the floor.

The rack is easily rolled to the spot where the assembling is to take place, or where clamps are taken off a project. The clamp rack is easily made and requires but little material. It will be found to be a big timesaver.

C. Procedure

1. Lay out two 12-in. circles on the plywood. (7/16-in. basswood may be used, but if used, it is advisable to nail small blocks of wood between the wooden discs.)
2. Cut out the discs and true them with sandpaper.
3. Drill 3/16-in. holes in the center.
4. Cut out a 3½-in. circle on one of the discs, midway between the center and the circumference. Save this 3½-in. disc, as it will be used for the cover.
5. Cut a 3-in. hole in the 5-in. plywood disc and nail it on the inside, covering up a part of the 3½-in. hole, thus making a shoulder for the cover to rest on.
6. Fasten the 3½-in. disc with a small hinge and a hook.
7. Cut out two 2-in. discs of 22-gauge galvanized iron.
8. Punch four holes in each disc, ¼ in. from the outside. Space them equally around the circumference.
9. Drill a 3/16-in. hole in the center.
10. Place the metal disc on the wooden disc, so that the 3/16-in. holes coincide, and drill small holes in the plywood through the punched holes.



A LIME LINE-MARKER

Ira C. Madden, Detroit, Michigan

At this time of the year most schools are engaged in outdoor sports.

Many of these sports and games require the use of guide lines. As there is generally a great deal of rain during the spring and early summer, it is necessary to make new lines every few days, and often every day. Many schools are required to make these lines by hand. This is unsatisfactory, as it is not only tedious, but one cannot do a uniform job. The line-marker herewith described has proved quite successful. It is inexpensive, and can be made by the industrial-arts department. It is filled with lime through a 3½-in. hinged door. The following job sheet will explain how it may be made.

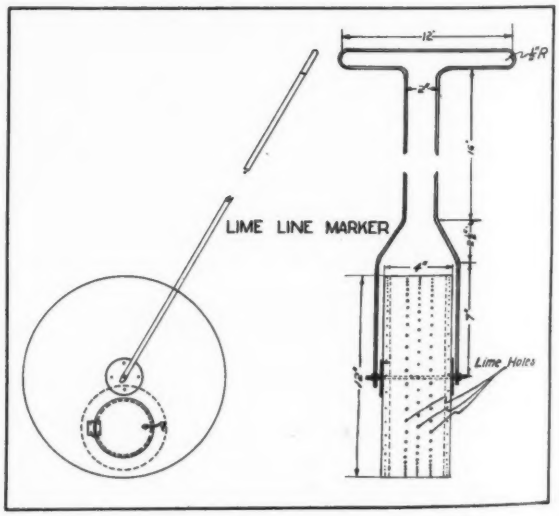
Job—To Make a Line-Marker

A. *Material*

2 pieces of ⅜-in. fir plywood 12 in. square
1 piece of ¼-in. fir plywood 5 in. in diameter
1 piece of 28-gauge galvanized iron 4 by 38 in.
2 pieces of 22-gauge galvanized iron 2 in. in diameter
1 piece of strap iron 3/16 by ¼ in. by 6 ft.
1 round rod 3/16 by 6 in.
1 small hinge
1 hook
4 nuts to fit 3/16-in. threaded rod

B. *Tools and Equipment*

Coping saw; compass; brace; auger bit; ruler; hammer; solid punch; awl; mill file; monkey wrench; tin snips; hack saw; small round stake.



11. Insert 6d nails through these holes and rivet them to the metal disc.
12. Cut out a piece of 28-gauge galvanized iron 4 by 38 in.
13. Lay out two guide lines 3/16 in. from the edges and start nail holes with an awl.
14. Lay out a center line and two lines ¾ in. from the center line.
15. Punch holes on these three guide lines ¾ in. apart. Alternate the holes so that they will not be directly across from each other.
16. Remove burrs with a file or with the emery wheel.
17. Nail the metal strip on the edge of the discs using shingle nails.
18. Solder the joint.
19. Cut off a piece of ¼-in. strap iron 6 ft. long.
20. Drill 3/16-in. holes ⅜ in. from each end.
21. Make the "T" bend for the handle over a small round stake. The other bends are made in the vise. Twists may be made in the center if desired.
22. Thread the 3/16-in. rod on either end for a distance of ⅞ in. Insert the rod through the holes in the discs and put a nut on either end. Put the handle on and put a nut on the outside and tighten securely.
23. Paint.

FACULTY MAIL BOX

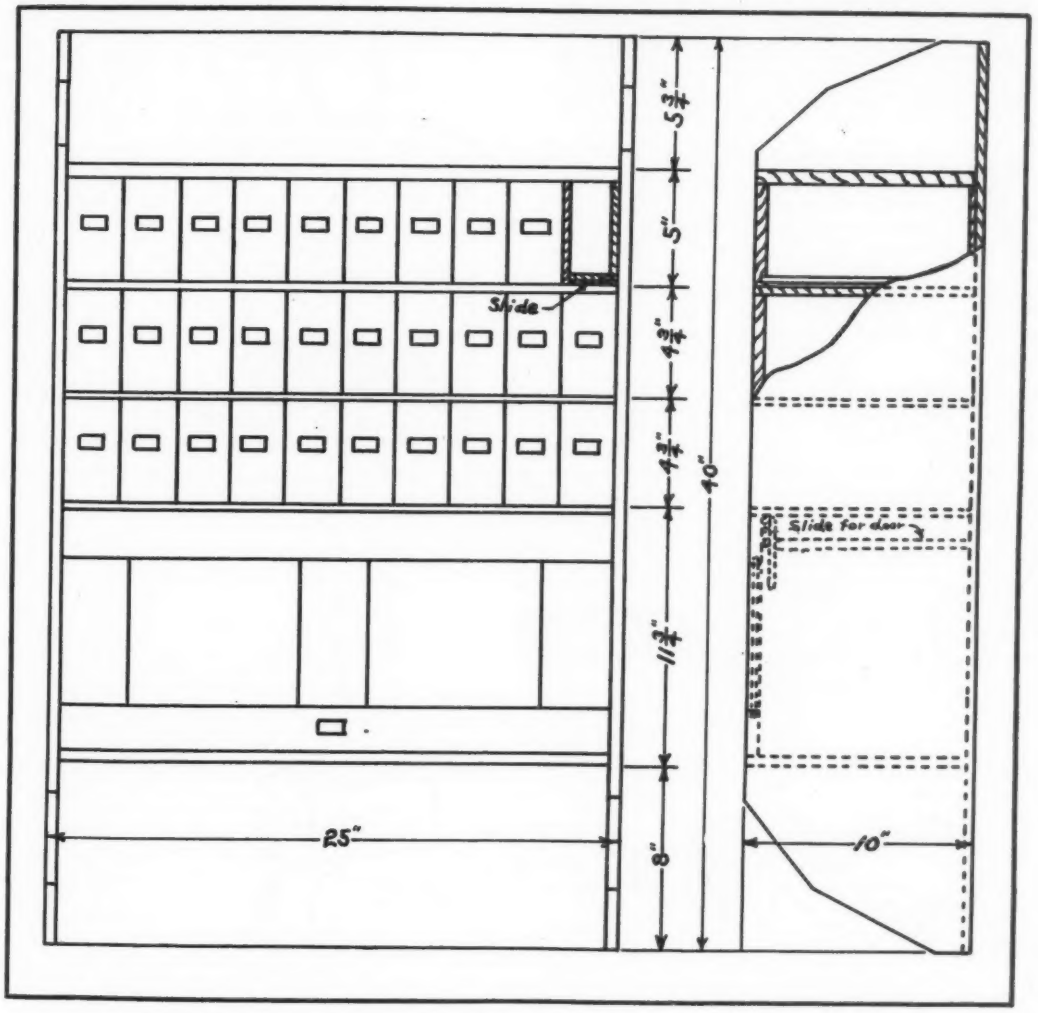
G. H. Billingham, Woodrow Wilson High School, Weehawken, New Jersey

Our department was asked to furnish a means of caring for the faculty mail. It was stipulated that it must not take up too much space in the lobby of the office. Of course, it had to be finished the same color as the woodwork and harmonize with the furniture.

The illustration shows the finished product. It had 30 individual drawers, each large enough to hold 20 average-size business envelopes. The lower compartment is large enough to care for such things as newspapers, magazines of the type of the INDUSTRIAL-ARTS MAGAZINE, and packages that otherwise would clutter up the office table before being claimed by the instructors for whom they were intended. The door to this section can be raised and slid back out of the way similar to the doors on sectional bookcases. This saves space and also makes it easier to remove articles since both hands are free.

The drawers are made in the usual manner. They can be sawed out on a circular saw, and make a fine project for a boy who is interested in machine operation. Great care must be taken in assembling, as the wood is thin. For this reason the nail holes should be started with a drill. Two boys working together can handle this part of the work nicely. Of course, all of the pieces should be well sanded first, and after the boys have completed the nailing, another boy should shellac the boxes both inside and out. The front should receive three coats, each being sanded smooth with very fine paper, and then a thin coat of rubbing varnish applied. Half-inch chestnut was used for the main parts on our mail box, with three-ply basswood for the sides, back, and bottom of the drawers.

The slide fastener for the door was made of angle iron. This was sawed in half at the bend, and then a ¼-in. section sawed out lengthwise for about three inches. This was an interesting job for the boys and made an inexpensive piece of hardware.



FACULTY MAIL BOX, DESIGNED BY G. H. BILLINGHAM, WEEHAWKEN, N. J.

Our department does not do repairwork around the building, and we do not furnish many things for school use. Unless the school has a four-year course in shopwork, the time allotment is such that it usually falls on the instructor to complete such problems. A problem of the kind I have just explained, interests the boys when they do not see or partake in too much of it. I have found that some boys would rather work on a project of this kind that attracts attention by its originality than do some lesser jobs for themselves.

A DRAFTSMAN'S POINT PENCIL SHARPENER

H. D. Campbell, J. S. Morton High School,
Cicero, Illinois

The ordinary pencil sharpener is quite unsuited for the drafting room since the point produced is so short that, after one or two pointings on the sandpaper block, it needs resharpening. The life of a drawing pencil is, under these conditions, all too brief.

Whittling a long point takes time and, in the present-day knifeless class, usually results in the instructor losing a succession of pocketknives.

A draftsman's point sharpener will solve this problem, but at a cost which is prohibitive in many schools.

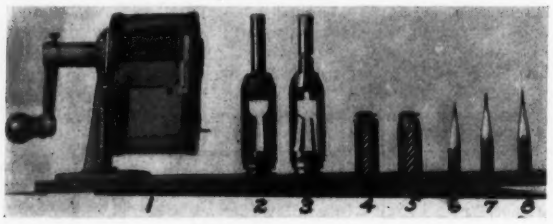


FIG. 2

The accompanying drawing and photographs show how an ordinary dollar sharpener of a standard make may be revised to do the work of a six-dollar draftsman's point sharpener with but very little work in the machine shop.

During the past eight months, three such sharpeners have been in constant use with complete success in our drafting rooms.

While but one make of sharpener was so revised, the writer believes that any similar sharpener can be made over if the same method of working out the problem is followed.

Referring to Figure 1, it will be seen that the necessary steps are:

1. Determine the angle of the axis of the cutters and their distance at each end.
2. Draw angle and cutters.
3. Draw parallel lines on each side of the center line of th cutter holder representing the diameter of the pencil lead.
4. Determine the angle which must be ground off and th length of this ground surface.
5. Have cutters tapered this amount with the tool-pos grinder.
6. Have web which originally acted as a stop for the penci lead filed away so that an unsharpened point of the desire length is produced.

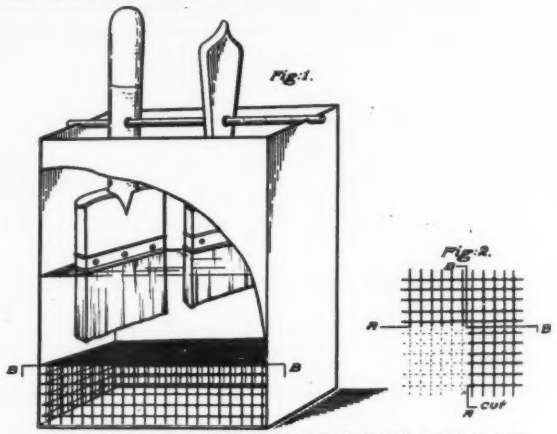
Referring to Figure 2, we have:

1. The sharpener assembled.
2. The cutter holder before the notch was filed.
3. After the notch was filed.
4. Cutter before grinding.
5. After grinding.
6. Point as originally produced.
7. Draftsman's point before filing.
8. After filing and ready for use.

CONTAINER FOR SAFE-KEEPING OF VARNISH BRUSHES

R. Forkel, School of Industrial Arts,
Trenton, New Jersey

The accompanying illustration shows a container used for the safe-keeping of varnish brushes. It contains an extra bottom made of galvanized mesh wire, four meshes to the inch, which is raised about 1½ in. from the bottom. This screen is removable for cleaning. All settlings, dust, etc., and also waste of varnish which is left in the brush, will settle below the screen at the bottom when the brush is immersed in the turpentine or kerosene in the container.



CONTAINER FOR KEEPING OF VARNISH BRUSHES

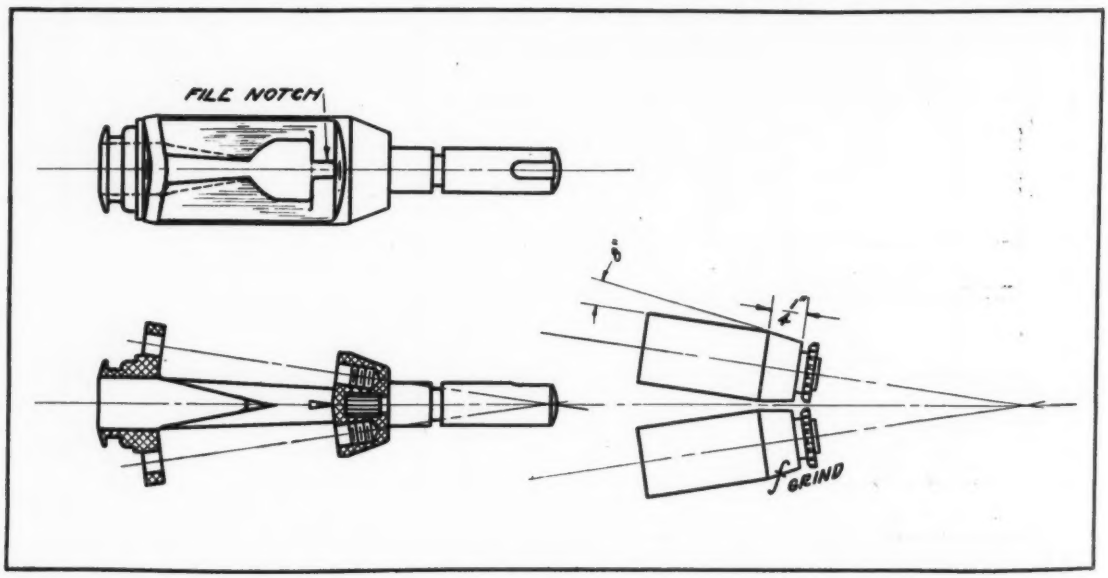


FIG. 1

Should the brush slip accidentally while it is being removed from the rod, or should a student drop it in a careless way into the container, it will only hit the screen bottom and not come in contact with the settlings at the bottom.

This container will always keep the varnish brushes in first-class condition. It may be made out of an empty gallon or half-gallon varnish can, by cutting off the top, leaving the container 7 in. in height.

To make the screen bottom, take the galvanized mesh wire and cut it 1½ in. larger all around than the opening of the container. Then lay off the size of the container on it and cut the corners out as is shown in Figure 2 at AA. Next, bend the ends down at right angles as is shown at BB, Figure 1. The screen is then ready to be set in the container.

Small notches about ¼ in. deep should be cut or filed in the middle of the ends on top to hold the rod from which the brushes are hung. The bristles of the brushes should not rest on the screen. It is also advisable to make a cover for the container to exclude dust and dirt. This can be made out of another empty varnish can similar to the first one. Cut it so that the top will clear the brush handles, and solder a band about 1½ in. wide around the cut, allowing it to extend about ½ in. over the edges to fit over the container.

PATTERN STORAGE

T. B. McGraw, Erie, Pennsylvania

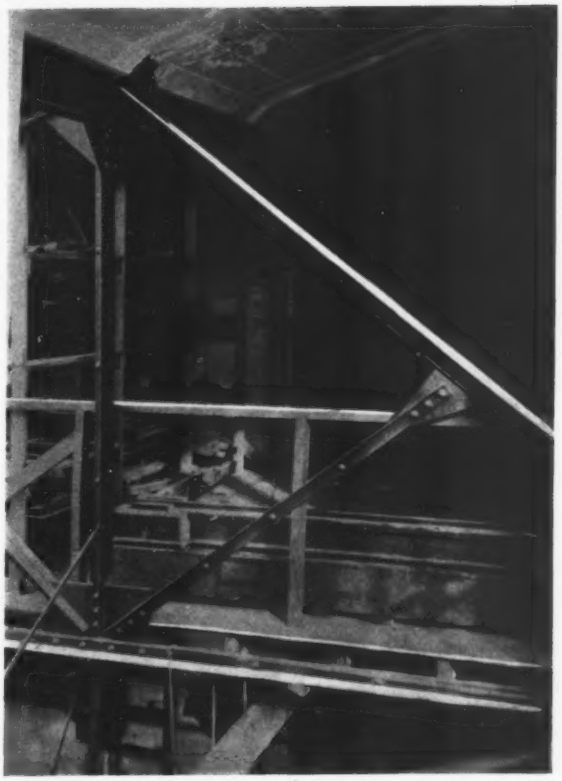
The problem of storing the fast accumulating patterns in the Academy High School pattern shop resulted in the loft shown in the accompanying illustration. Schools facing a similar situation might be interested in our solution.

The loft is built in a corner of the shop, near the ceiling. It is reached by a ladder which is fastened to the wall as shown in Figure 1. It consists of 25 bins approximately 18 by 32 in. with a depth of 24 in. The bins are arranged on each side of an aisle which is approximately 3 ft. wide. They are numbered for reference and their construction is shown in Figure 2.

The system for ready reference and location of the desired patterns when castings are required, is copied directly from industry. It consists of a card index which contains all the needed information. This card is shown in Figure 1.

Through this system, any student can locate the desired patterns in a few minutes and be sure that no loose pieces are missing. It no longer becomes necessary to make additional pieces to replace those which have been lost or mislaid.

If the floor space of the school shop is large, the pattern storage bins may be built in one corner of the room on the floor or against the wall.



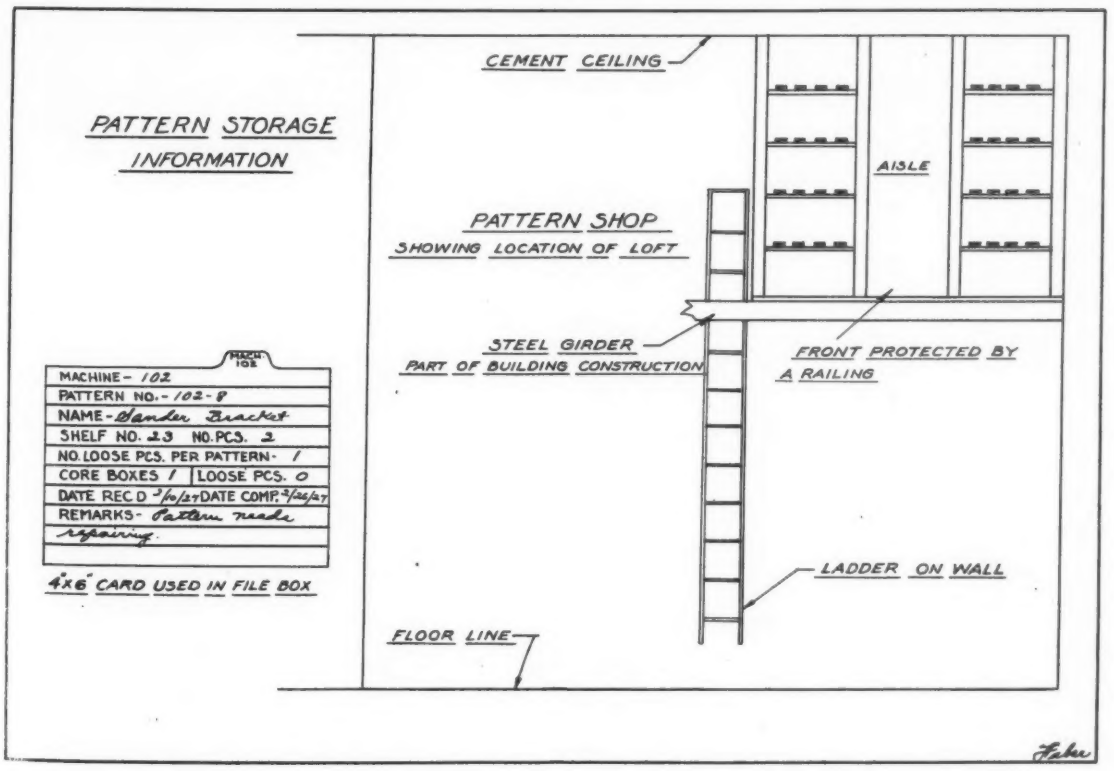


FIG. 1

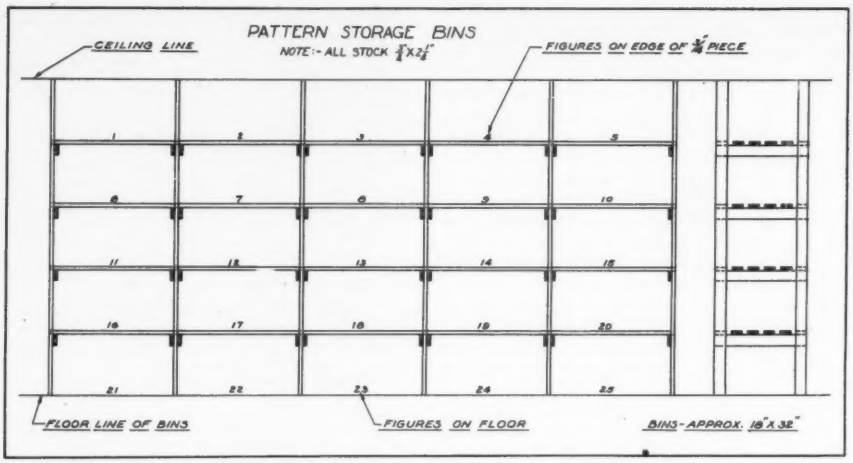


FIG. 2

A HOLDER FOR GRINDING CHISELS

Eugene C. Graham, Manhattan, Kansas

There is real satisfaction in using a chisel or a plane which has been so well sharpened that it will cut smoothly and easily in any kind of wood. If we fail to provide boys with helps in grinding these tools we make it so hard to get a good edge on tools that many of them never find out how easily a sharp tool cuts. With this holder, any boy can grind a perfect hollow-ground bevel on a grindstone or an emery wheel of the most common type.

This project also is a very satisfactory one for the farm shop, as it can be made with common tools and can be taken home and used on the farm. The cost of the material should not be over 25 cents and may be less.

In using the holder, the chisel or plane bit is clamped in firmly as shown in the illustration, and the sharpened spike set firmly in the top of a sawhorse placed in line with the grinding wheel.

If the emery wheel is mounted on a bench, a block may be tacked to the bench in the right position to give the proper bevel. Any bright boy can devise a way to adapt the holder to a different type of grinder.

The wooden part of the holder may be worked out of a piece of maple or oak ⅞ by 2¼ by 22 in. with ripsaw, coping saw, chisel, or drawknife and block plane. If a turning lathe is available, the stem may be turned.

If it is not possible to find a piece of steel to fit the yoke, a block of hardwood about ½ in. thick with a ¼-in. nut set into the lower surface may be used. It is not necessary to put a pin through the head of the cap screw, but it helps in clamping down the chisels.

It will pay to give the wooden part a coat of stain and two coats of hot linseed oil well rubbed in.

ADJUSTABLE MUSIC RACK

Dorcey E. Kellogg, Erie, Pa.

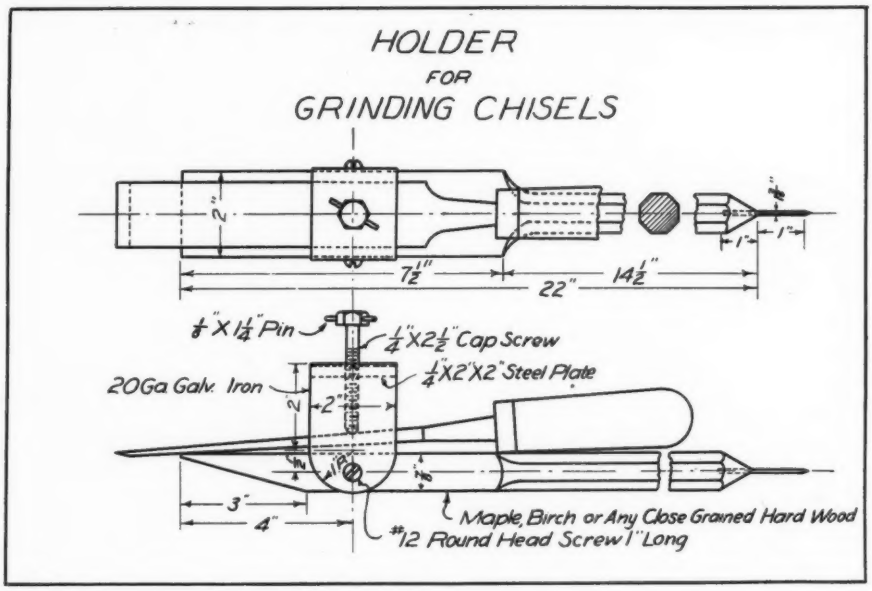
The adjustable, tilting music rack, shown in the accompanying illustration may be quickly made in any school shop. The rack is not easily upset, and the construction is quite sturdy.

The pipe and pipe fittings may be purchased from a hardware store, where they will cut them to the correct sizes and thread them if necessary.

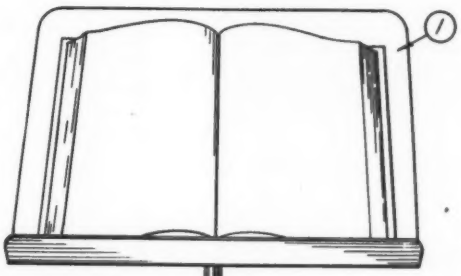
The desk part numbered 1, is laid out and formed over a square piece of wood. The holes are either drilled or punched. Parts numbered 2 and 3 are next laid out alike and formed at an angle of 90 deg. where marked, making one right-hand and one left-hand.

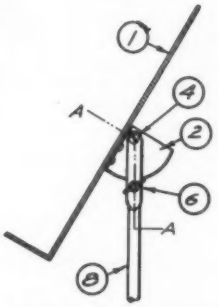
Part numbered 8 is flattened out at the top end as shown in detail at the right marked "Section at A-A." The groove which engages parts 2 and 3 is made with a saw. The lower end of part 8 is split with a saw cut and expanded slightly to make a snug fit.

The material list is added on the drawing to facilitate ordering the necessary pieces for the construction of the rack.



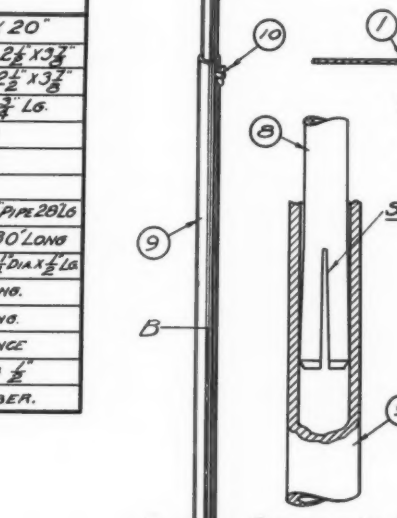
ADJUSTABLE MUSIC RACK



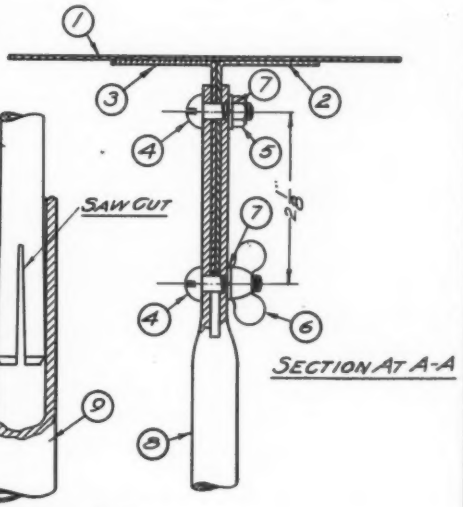


DESK TILT ASSEMBLY

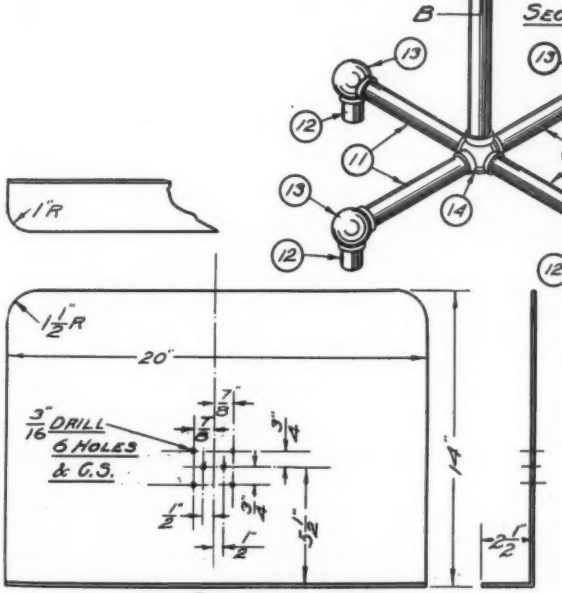
MATERIAL LIST		
PARTS NO.	PIECES REQ'D.	DESCRIPTION
1	1	DESK- #18 GA. 16½" X 20"
2	1	BRACKET R.H. #18 GA. 2½" X 3 7/8"
3	1	BRACKET L.H. #18 GA. 2½" X 3 7/8"
4	2	BOLTS. R. HD. 3/16" DIA. 3/4" LG.
5	1	NUT. HEX 3/16" TAP.
6	1	WING NUT 3/16" TAP.
7	2	WASHERS 3/16"
8	1	POST ADJUSTABLE 1/2" PIPE 28" LG
9	1	POST FIXED 1/2" PIPE 30" LONG
10	1	SET SCREW WINGED 1/4" DIA X 1/2" LG.
11	4	BASE 1/2" PIPE 7" LONG.
12	4	FEET 1/2" PIPE 2" LONG.
13	4	ELBOWS 1/2" BALL FENCE
14	1	SIDE OUTLET CROSS 1/2"
15	4	CRUTCH TIPS - RUBBER.



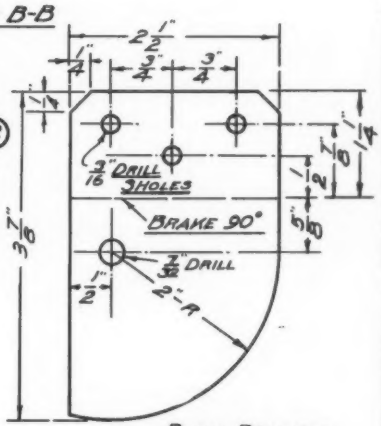
SECTION AT B-B



SECTION AT A-A



(1) DESK #18 S.G. PLATE



DESK BRACKET

(2) MAKE 1 - RIGHT HAND

(3) MAKE 1 - LEFT HAND

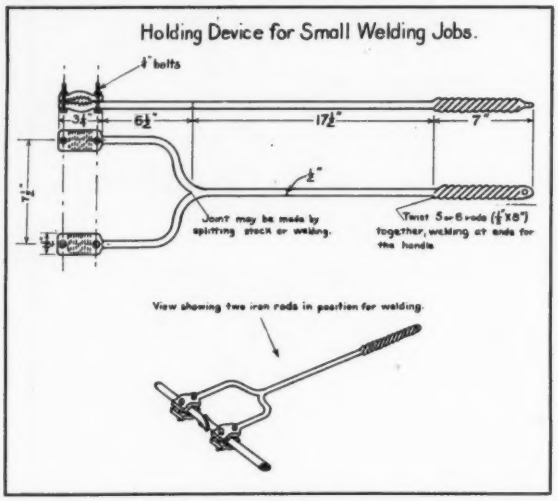
DESIGNED BY D. E. KELLOGG.

HOLDING DEVICE FOR SMALL WELDING JOBS

Wm. Harry Phipps, Teachers College, Charleston, Illinois

Sometimes experienced blacksmiths, trying to get a smooth-looking job and a strong joint, will have trouble welding two small rods end to end. Here is a device which any school-shop instructor or advanced student can easily make, and with it small boys in forge practice can easily weld two pieces together.

The two ends to be welded are held firmly in the proper place and heated uniformly to the welding heat. Then they are placed on the anvil and driven together without slipping from their right positions.


Holding Device for Small Welding Jobs.
bolts
Joint may be made by splitting stock or welding.
Twist 5-in 6 rods together, welding at ends for the handle
View showing two iron rods in position for welding.

The finished shaping sometimes can be done easier by taking the stock from the holder and handling it with tongs. This gives the piece a chance to stretch out and the joint to be made the same size as the rest of the rod.

The given measurements of this device may be varied according to the wishes and tastes of the person making it.

A CABINET BENCH MADE FROM AN OLD DOOR

C. A. Upson, Hammond Technical High School, Hammond, Indiana

The boys who have home shops frequently have not the money to buy a good workbench. An old door may readily be used to make a good sturdy bench that will satisfy most needs.

We recently made such a bench in the school shop from a cross-paneled-type door, the upper part of which was glazed. The door was 1⅝ by 34 by 78 in. Figure 1 shows what parts of the door were used, and Figure 2 shows where they were used on the bench. The parts were fastened together with ⅜-in. machine bolts and washers. The four upper bolts were 7 in. long, while the lower ones were 3½ in. long. If desired, the corner joints can be further strengthened by using dowel

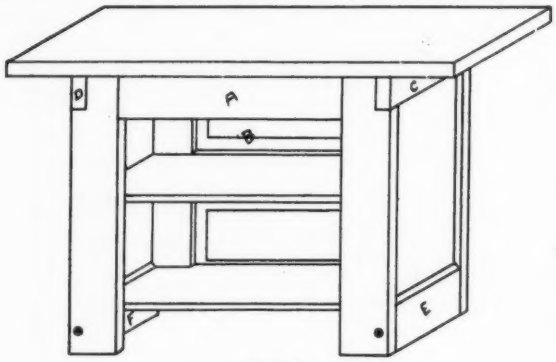


FIG. 2

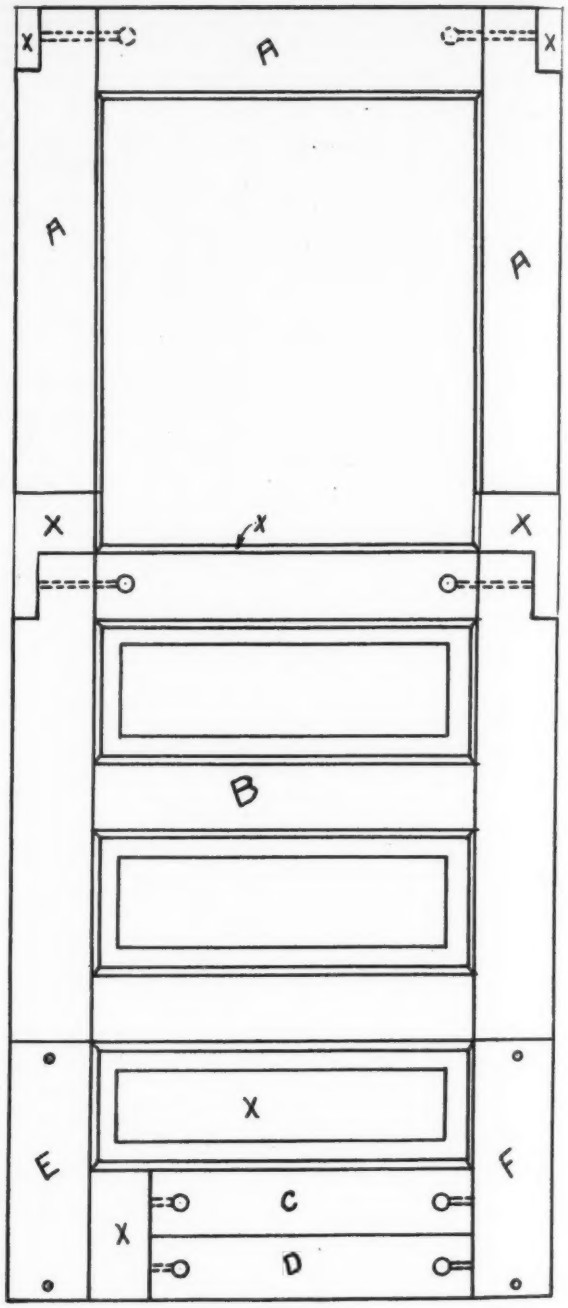


FIG. 1

pins. The top, which measures 2 by 24 by 48 in., was made from an 8-ft. plank.

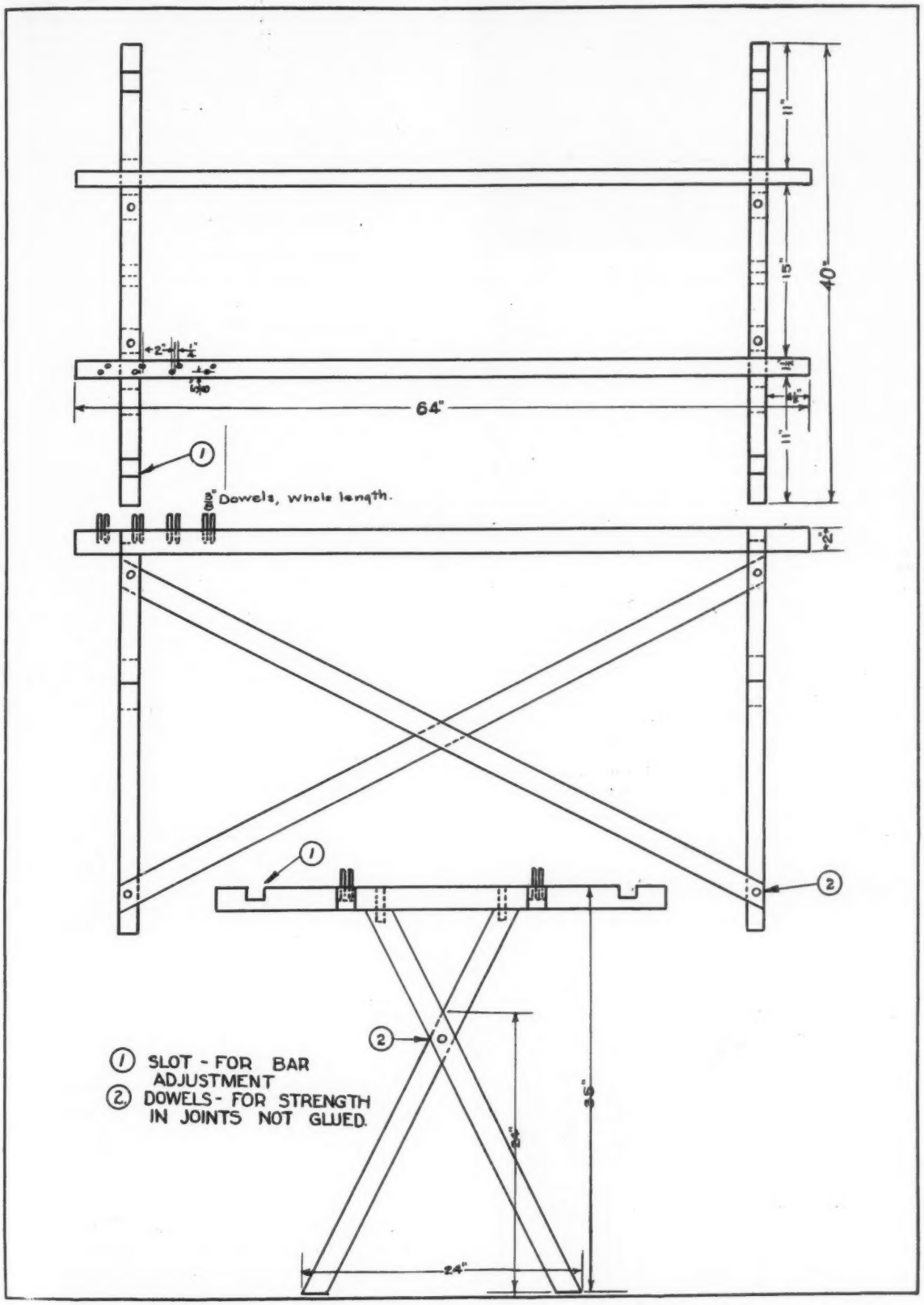
Fastening the pieces which composed the bench with bolts makes the job of taking down the bench for moving very easy.

A CLAMPING RACK

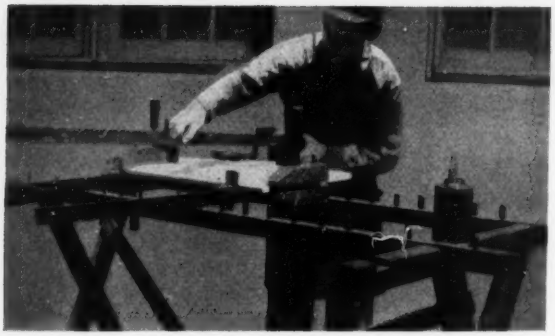
Henry H. Batchelder, Point Loma Junior-Senior High School, San Diego, California

Nothing in the school woodshop demonstrates more clearly the up-to-the-minute methods of instruction than the gluing corner, and nothing improves the efficiency, cleanliness, general morale and appearance than a well-lighted, well-equipped, corner for all gluing operations.

Each shop glue corner usually has the traditional glue pots, block box, and clamp rack, but the accompanying illustrations



CLAMPING RACK, DESIGNED BY HENRY H. BATCHELDER, SAN DIEGO, CALIF.



show a student-made clamping rack which has proved its worth in many ways.

The clamping rack can be made as a student project and with the usual exercises has new elements of construction as cross bracing, demountable joints, doweling, and cross half-lapping. The inexpensiveness is proved by the fact that it may be made of scrap lumber. Before it is put into use it is given a coat of linseed oil.

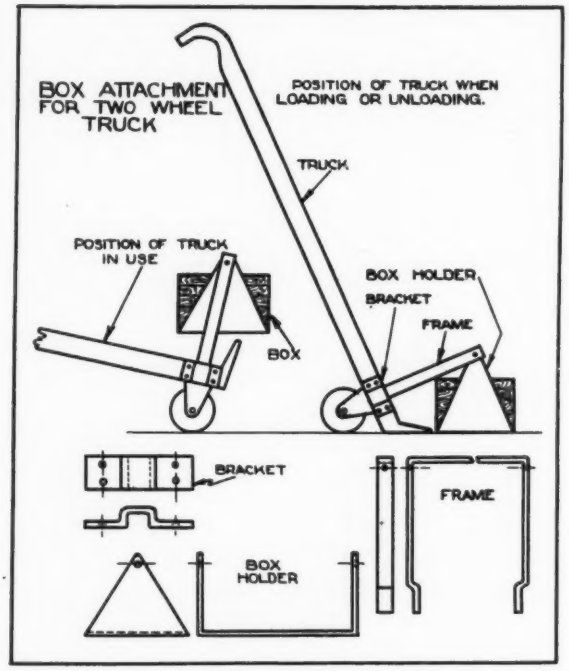
This rack is made with loose, half-lap and dowel joints so that it can be torn down in two minutes and moved from place to place. It is adjustable for various length clamps, and widths and lengths of boards. Glue will not stick to the rack because of the oil finish, and one boy can work most difficult glue jobs with ease and comfort, knowing that his clamps are held in place by dowels which act as the fingers of a helper. With this rack, even seventh-grade students can complete glued jobs without the over-constant supervision and help of the teacher.

BOX ATTACHMENT FOR TRUCK

H. Moore, Hamilton, Ont., Canada

The ordinary two-wheeled truck used in most schools and shops is not well adapted for carrying boxes full of material that are easily spilled. To avoid the annoyance of losing part of the load when lowering the box, the attachment shown in the illustration may be added to the truck. It enables one to pick up, move, and set down a box, keeping it level all the time.

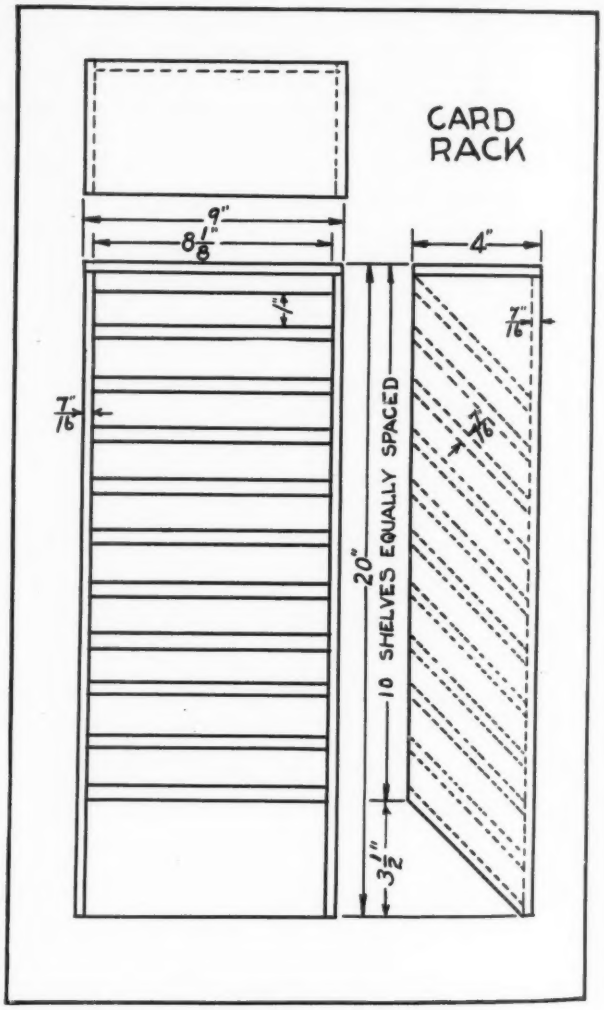
First of all, two bracket pieces are bolted to the sides of the truck. Then a frame is made out of strap iron, which slips into these brackets. Finally, the actual box holder is made out of ¼-in. sheet metal. This holder must be riveted to the frame, but in such a manner that it turns freely. Now, when any boxes have to be moved, the frame is slipped into place, the box is pushed onto the holder, and then the leverage of the truck is used to raise it from the floor as shown in the illustration.



HEALTH-CARD FILE FOR THE GYMNASIUM

Joseph A. Miecikoske, Munger Intermediate School, Detroit, Michigan

In the intermediate schools where the enrollment is always large, the instructors would have great difficulty in keeping their class records in an orderly manner were it not for the use of some kind of cabinet file.



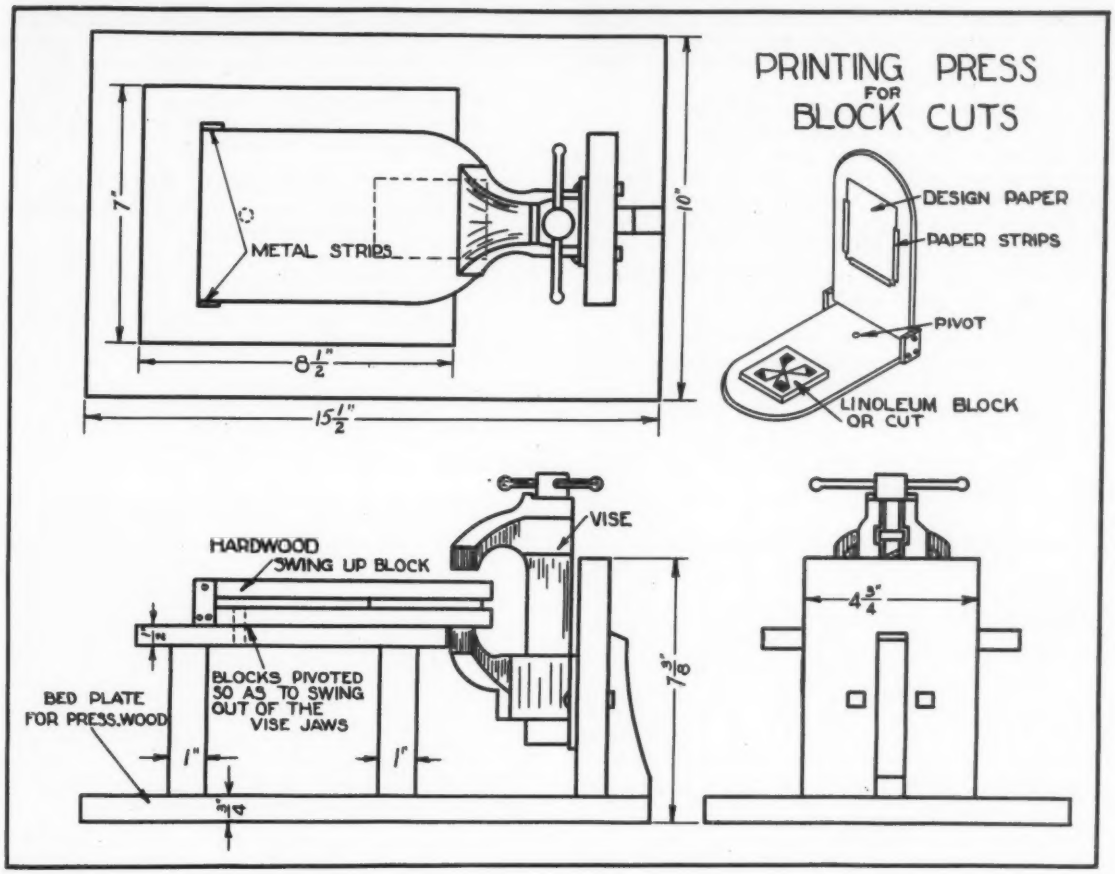
One of the gymnasium instructors at this school sent a request to the shop for a card file to take care of the great number of health cards that he had to look through whenever he wanted to look up some pupil's record.

The accompanying illustration shows the card rack that was made to take care of his needs.

A SMALL PRESS FOR LINOLEUM CUTS

F. M. Keith, Senior High School, Ft. Smith, Arkansas

The simple press described herewith is a most satisfactory device for making prints from linoleum cuts. It should prove especially valuable to teachers of graphic arts who teach linoleum block cutting as a part of their instruction. The great need, however, is in the industrial-arts department where cuts



are made for all manner of printing work. When a proof is needed, it is a simple matter to insert the cut in this press and spin the vise handle. Then, too, this device is very valuable when two- and three-color jobs are wanted. Setting such a job in a platen press for making a proof would be a waste of time and a great deal of trouble. Moreover, if a printing press is not available, a neat job of any number of colors can be turned out by means of this device.

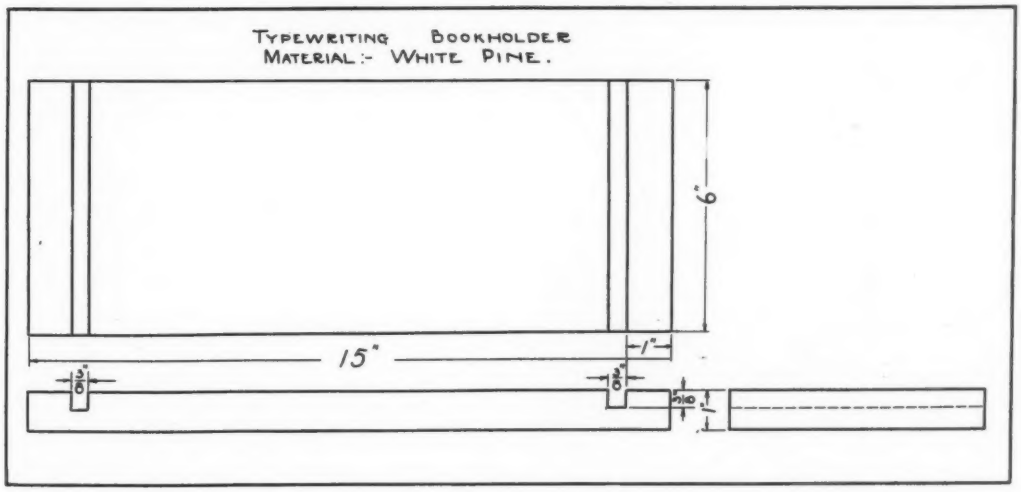
The press may be constructed very cheaply, as the vise is the only item of expense. A small vise, not costing more than $3, may be used. The framework may be constructed of any kind of cheap wood. It is suggested that the lower block be of white pine and the upper block of hardwood. The design paper should be held in place on the upper block by paper strips, as illustrated. The cut may be placed on the lower block and held securely by cardboard strips tacked to the white-pine block.

The size of the device is optional, but the size shown is convenient for most jobs. It will print cuts up to 4½ by 7 in.

TYPEWRITING BOOK REST

U. L. Hiatt, La Junta, Colorado

The typewriting department of our senior high school was in need of a rest or holder which would support the typewriting exercise book at the proper angle for copy practice. The book is 8 by 10 in. and bound on the end. We tried a board 1 by 6 by 15 in. with a dado cut at each end to hold the covers of the book. This holds the page at a nice angle for

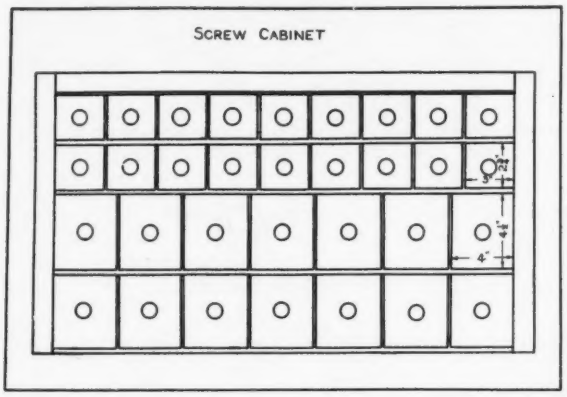


the student to read. The ,fine thing about this holder is that it lies flat on the table and is not easily tipped over. The teachers in charge of the typing department were highly pleased with the device.

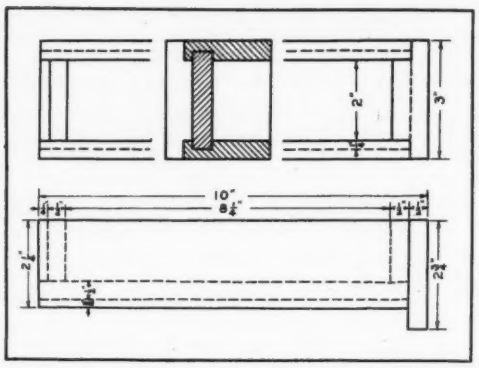
SCREW AND NAIL CABINET

V. L. Huddleston, Arkadelphia, Arkansas

The problem of keeping nails, screws, and other supplies properly sorted and in easy reach of the student is one that confronts every industrial-arts teacher. I have seen a great many different designs, but have never had a cabinet that fills requirements as the one described herewith does.



All parts for the drawers should be cut on the saw. The drawers should be made a fairly close fit. When properly nailed, they will stand hard usage for years. The larger sizes should be made of material of the same thickness as the

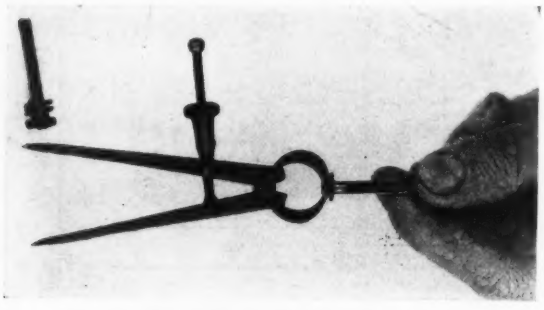


smaller sizes. Any cheap, easily worked wood will do. The number of drawers to be made depends on the size and requirements of the shop. If the cabinet is neatly made and properly labeled, it makes an attractive addition to any shop.

NEAT REPLACEMENT OF DIVIDER PART

Frank W. Bentley, Jr., Missouri Valley, Iowa

The small handle or finger grips found on light spring dividers very often get lost or broken. A neat repair part may be found by pounding open an old screw connector dry cell. The brass portion in the hard carbon center electrode is seemingly just made for repairing these dividers. The long portion is lightly knurled, and the small threaded end may be filed down if necessary for riveting in the bow spring as shown. The collar or shoulder on the piece keeps the riveting and the whole handle tight to the spring.

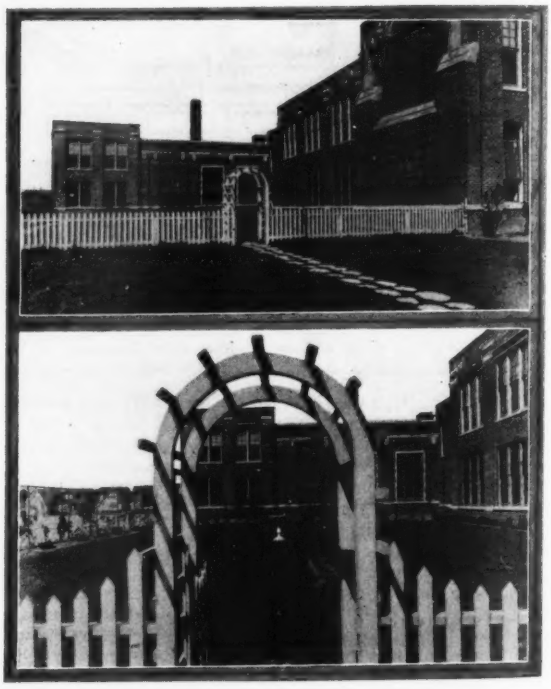


THE REPAIRED DIVIDER

BEAUTIFYING SCHOOL GROUNDS

Earl L. Bedell, Supervisor of Vocational Education, Detroit, Michigan

The garden fence shown in the accompanying illustration, was designed and built by the boys in the household-mechanics class of the Fitzgerald school of Detroit. Mr. Delmar Pardonnet, the shop teacher, says the undertaking of so large a project means lots of real work, but the results obtained more than repaid for all the effort it took. The fence incloses the school garden which was arranged by the class in general science. The bird bath gave opportunity to use Portland cement, and we may as well confess, the flagstone walk is not made of flagstone, but it is made by pouring cement into irregular-shaped slabs.



Shop teachers who do not build up a community spirit through the development of worth-while community projects, of which this school garden is a sample, are missing an opportunity for some real teaching. And boys are eager to contribute their thought and work to projects of this nature, especially when their work is praised by the parents and other adults of the community. These boys could have for their motto, "We Build."

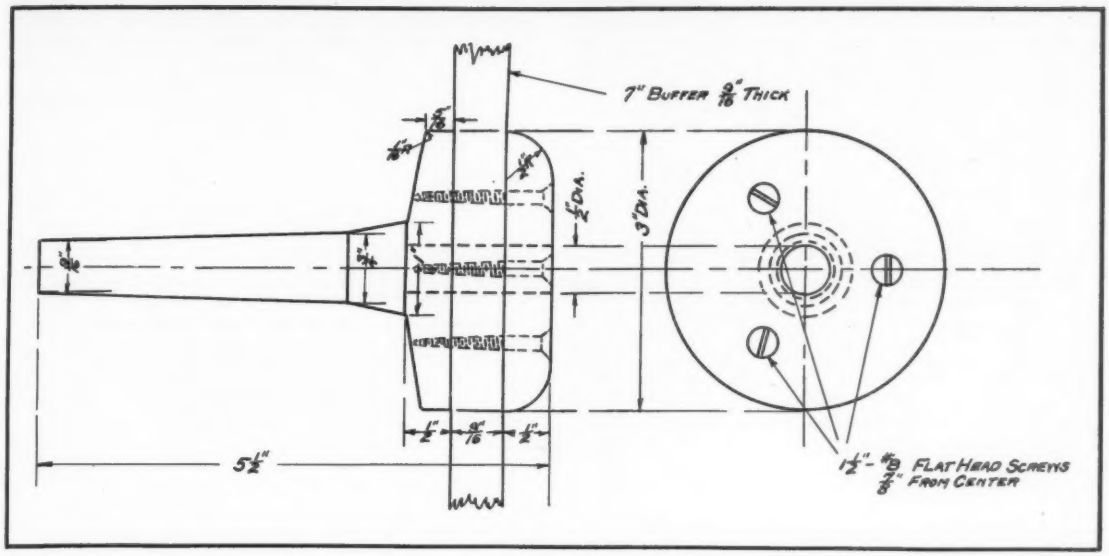
WOOD LATHE BUFFER

Merlin J. Finch, West Orange High School, West Orange, New Jersey

With the increase of copper and brass work in both the junior and senior high-school shops, the need of a buffing device is frequently felt.

The buffing attachment illustrated herewith may be made of any stout wood. We used oak and found it very satisfactory.

The shaft is tapered exactly the same as the spur center of the lathe and enters the lathe approximately three inches. A ½-in. hole is bored through both flanges before being cut out on the band saw. The inner flange is glued to the shaft against the 1-in. shoulder and turned to shape. The outer flange has holes drilled and countersunk ⅞ in. from the center for the screws.



WOOD-LATHE BUFFER

Have a ½-in. hole cut in the center of the cloth buffing disc when you purchase it, as they usually have but a small hole for the metal buffing device.

To assemble, insert three 1½-in. No. 8 f.h.b. screws in the outer flange, and work them through the disc into the inner flange. Replace the device in the lathe and turn the outside flange. Shellac the surface of the wood and the buffer is ready for use.

NOTE: Tools may be given an extra-fine edge with the buffer after honing. This is especially true of gouges.

CARVING-TOOL KIT

Jos. J. Lukowitz, Milwaukee, Wisconsin

Where to keep special tools is sometimes a perplexing problem. In most cases, it is desirable to have sets of tools so arranged that they may be easily moved from bench to bench. This "portability" is especially desirable with carving tools.

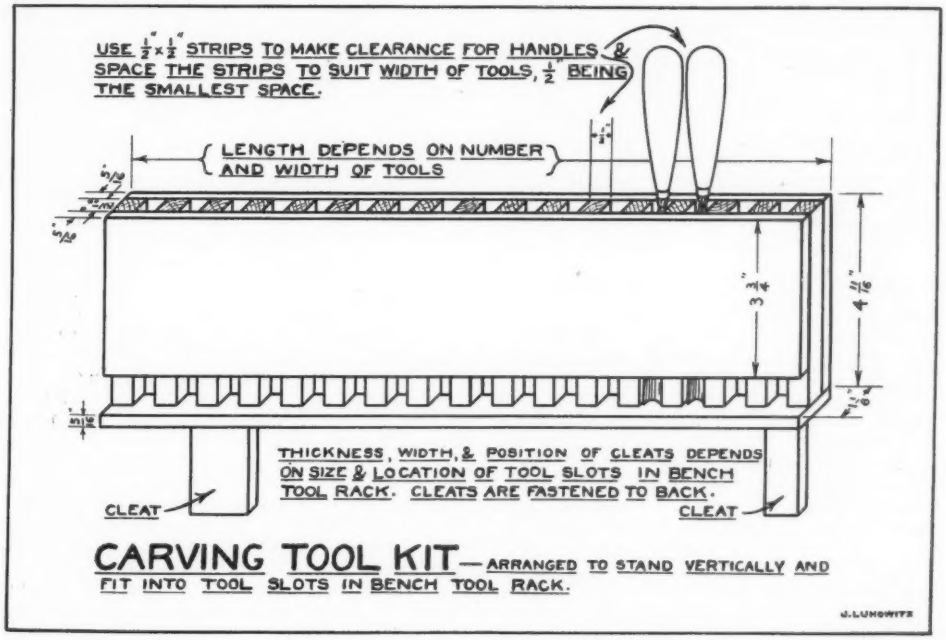
Needless to say that an ordinary box is unsatisfactory, for the cutting edges will unavoidably come in contact with the other tools and thus be dulled. The kit illustrated herewith possesses not only the advantage of portability, but it also makes checking easy; a glance will detect the gap in the row of handles which indicates a missing tool. It also takes a minimum amount of space on the bench, cannot be pushed off accidentally, and nothing can be piled on top of the tools with consequent danger to their cutting edges.

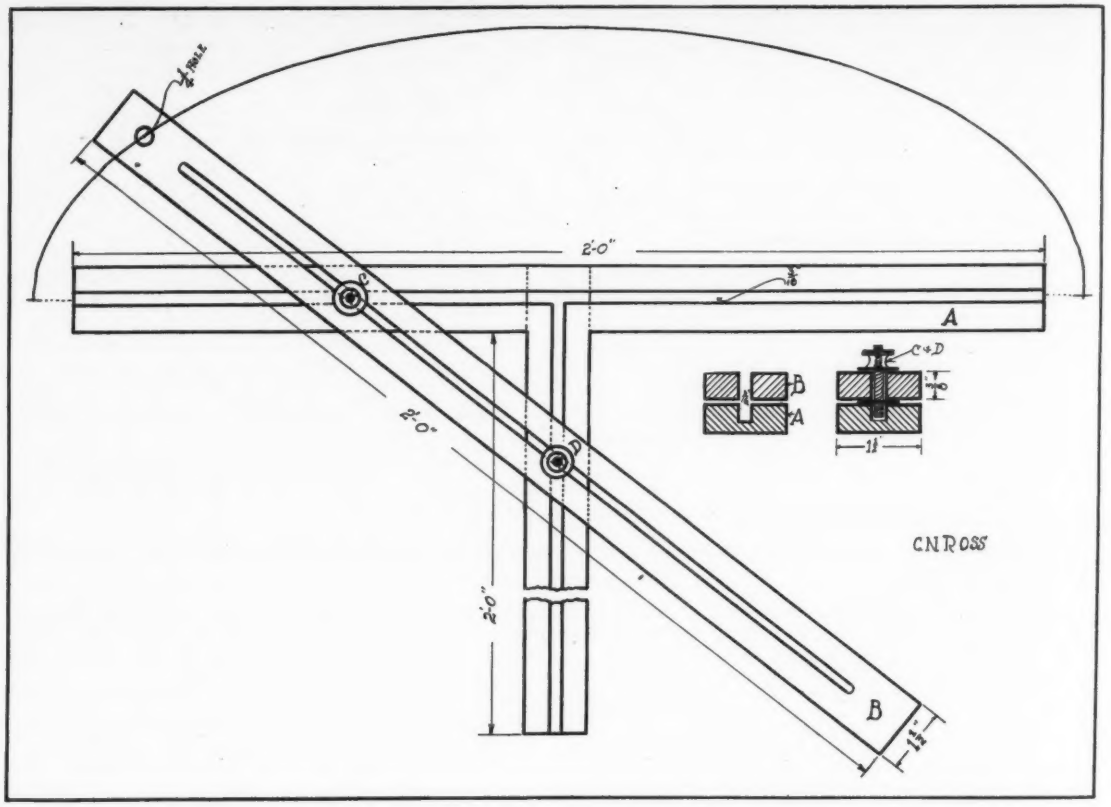
A good place for all of the tools in the shop, and the practice of keeping them all in their respective places when not in use, will not fail to make a favorable impression on the student and develop in him a habit of orderliness.

AN EASY METHOD OF DRAWING AN ELLIPSE

C. N. Ross, San Jose State Teachers College, San Jose, California

The project described herewith has been used by the writer for a number of years in the planing mill and has been found to be a very useful tool. In California, and in some sections of the country where Spanish architecture takes a prominent place in the building industry, it is especially useful for laying out all window and door frames and, in fact, anything in the way of an ellipse. It eliminates the old two nails and string method and is far more accurate. It is likewise a valuable thing in the school shop for laying out ellipses.


USE ½"×½" STRIPS TO MAKE CLEARANCE FOR HANDLES & SPACE THE STRIPS TO SUIT WIDTH OF TOOLS, ½" BEING THE SMALLEST SPACE.
LENGTH DEPENDS ON NUMBER AND WIDTH OF TOOLS
3¾"
4 11/16"
THICKNESS, WIDTH, & POSITION OF CLEATS DEPENDS ON SIZE & LOCATION OF TOOL SLOTS IN BENCH TOOL RACK. CLEATS ARE FASTENED TO BACK.
CLEAT
CLEAT
CARVING TOOL KIT — ARRANGED TO STAND VERTICALLY AND FIT INTO TOOL SLOTS IN BENCH TOOL RACK.
J. LUKOWITZ



A HANDY ELLIPSOGRAPH, C. N. ROSS, SAN JOSE, CALIF.

It is simple to make and the accompanying sketch gives all the data necessary. It can be made of any size to meet the demand, but I find that the one shown is very satisfactory for most shop use. I have one made of mahogany and another of maple. Birch also is very satisfactory. For the two pivots C and D, the terminal screws of an old dry cell may be used. A small washer should be soldered to the brass terminal bolt about 3/16 in. from the bottom end. A 3/16-in. dado saw cuts a groove of the proper size in the ellipsograph parts. A ¼-in. hole is bored in one end of the tracing bar for a lead pencil.

To get the proper size of a given ellipse, say an ellipse 6 in. high and 20 in. wide, measure 6 in. from the center of the pencil to the center of pivot C and fasten it. Then take one half of the width (10 in. in this case) and measure from the center of the pencil to the center of pivot D. Fasten as before. Place the pivots in the grooves as shown in the sketch and the pencil is ready to trace the desired ellipse. A trial or two will prove the value of this worth-while addition to the shop equipment.

There is practically no cost for materials in making this ellipsograph and it is a good project for someone in the class.

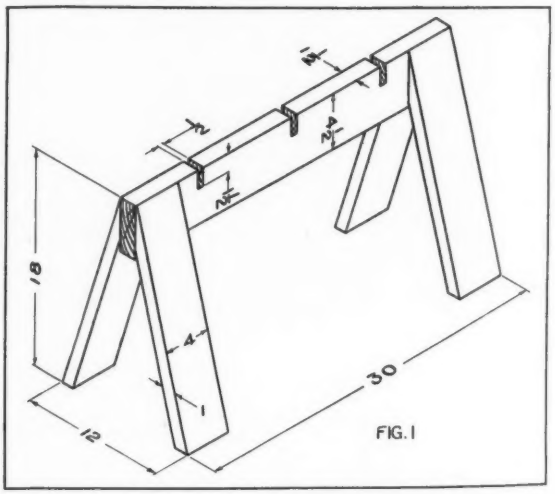
CLAMP HORSES AND CLAMP BLOCKS

Charles W. Frost, Albany, Oregon

The efficient use of hot glue depends upon the rapidity with which the glued edges, or joints, are drawn into permanent contact.

The speed with which this operation can be performed is governed by the manner in which material, glue, and clamps are arranged before work is started. Speed and accuracy are considerably facilitated by arranging the parts to be glued so that the piece required may be picked up without hesitation and by having the glue pot and brushes within easy reach. But all these expedients are in vain unless the clamps are efficiently handled.

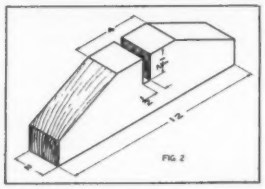
Most woodworking shops are equipped with long wooden bar clamps mounted upon sawhorse-like legs, but lack of space forbids these being kept in most manual-training shops in sufficient number to be of great value. Ordinary steel or wood bar clamps used without some sort of holding device necessitates calling another workman from his bench, as it is obviously impossible for one pair of hands to successfully handle two or more pieces of lumber and at the same moment hold a long heavy clamp in place while tightening its screws.



The clamp horse, shown in Figure 1, enables the workman to handle lumber, glue, and clamps quickly and easily without help. A pair of clamps the required length are placed in the slots in the top edges of the horses. The dogs on the clamps are set the right distance apart, and the pieces of wood are laid upon the clamps between the dogs as the glue is applied. When all pieces have been thus served, a couple of turns of each clamp draws the joints together tightly and evenly without interrupting the work of any other workman or student.

As the gluing of each piece is completed, it can be placed against the wall in an out-of-the-way corner, leaving the clamp horses and floor space for the next workman.

When not serving purpose for which they are designed, these clamp horses can be used as ordinary sawhorses.



Clamp blocks, such as the one shown in Figure 2, are particularly convenient for use with the short clamps and for working upon the benches.

The width of the slots should be just great enough to permit the clamp bars to slide into them with a minimum clearance. Different makes of clamps vary in thickness from a quarter to nearly half an inch, hence it is advisable to measure those to be used before sawing the slots.

The use of cold glue eliminates the necessity for excessive speed in gluing operation, but the clamp horses and clamp blocks are efficient timesavers whether used with hot or cold glue. A dozen blocks and a couple of pairs of clamp horses will be found well worth the slight expense for material and labor which is involved in making them.

A JIG FOR GRINDING CLEARANCE ON DADO-HEAD CUTTERS

Jonathan Bright, Academy High School, Erie, Pa.

A patent dado head, composed of inside and outside cutters, always cuts cleanly and quickly when new, but after it has been filed several times it begins to smoke and burn. Upon investigation it will be found that most of the clearance has been removed from the cleaner teeth of the outside and inside cutters. The obvious remedy is to grind the backs of these teeth until the proper amount of clearance is again obtained. This is best accomplished by using the jig shown in Figures 1 and 2. The outside cutters should be gummed and the inside cutters set with a swage. The entire head should then be assembled on the saw arbor and carefully jointed before starting to grind for clearance.

To make the jig, it is first necessary to make an accurate, full-size layout of one of the cutters. This layout will show the true center of the cutters and the eccentric center of the radius to be ground on the back of the teeth. The toolrest on the grinders is then removed and a flat board fitted in its place. No method of fastening this board is shown, as this will vary with the grinder available. A ¾-in. hole is bored in this board on a line with the center of the grinding wheel, and at a distance equal to, or slightly greater than the radius of the cutters. A hardwood pin is glued in this hole and allowed to project about 5/16 in. above the board. This is the center of the radius on the back of the teeth, and will be called Center No. 1. The board must be made of such a thickness that its top will be 7/16 in. below the center of the grinding wheel. When the eccentric and ⅛ cutter are placed on top of this baseboard, the center of the cutter is on a level with the center of the grinding wheel.

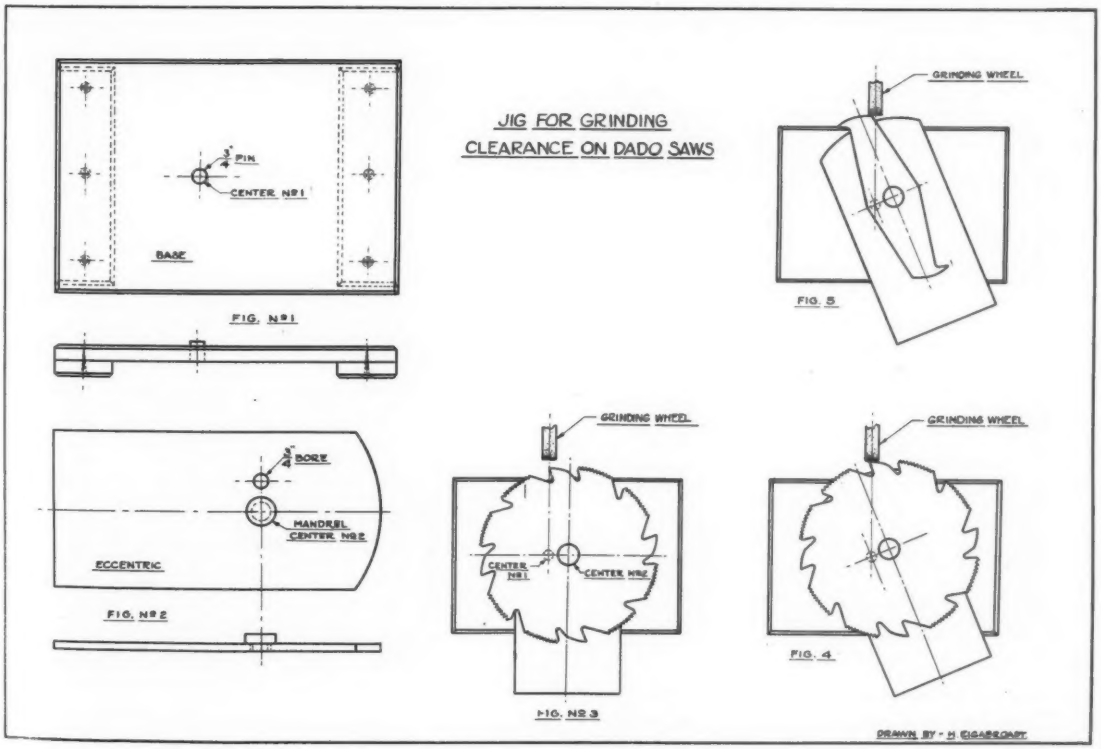
The eccentric is made of a piece of ⅜-in. veneer, cut as illustrated in Figure 2, and two holes bored in it the same size as the hole in the baseboard. A hardwood mandrel must then be turned to the diameter of the hole in the cutters with a pin to fit the hole in the eccentric. This mandrel must be glued in the right-hand hole, called Center No. 2. These holes should be as far apart as the distance shown in the layout and a distance less than the radius of the cutters from one end of the piece.

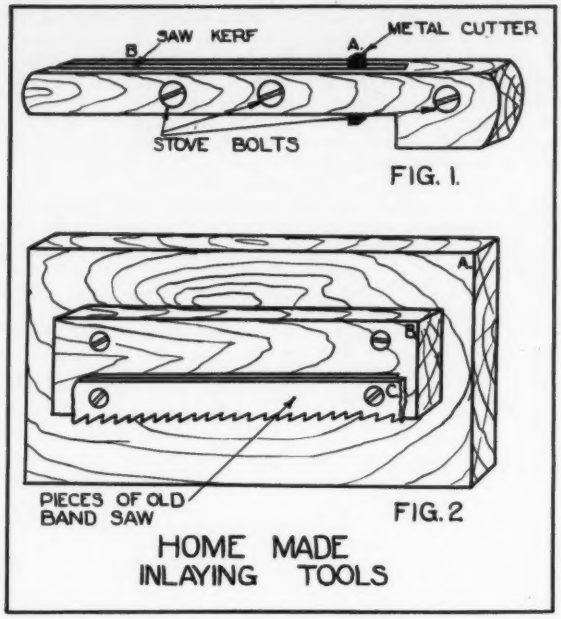
To operate the jig, place one of the cutters on the mandrel shown in Figure 2, and place the hole in the eccentric on the pin in the baseboard. (See Fig. 3.) Revolve the eccentric on Center No. 1, and the cutter on Center No. 2 until the high point on the heel of the cutter comes in contact with the grinding wheel. (See Fig. 5.) Be sure you understand the operation of the jig before you turn on the power. With the wheel running, revolve the cutter and eccentric about Center No. 1 and grind until the cutter no longer makes contact with the wheel. Revolving the cutter slightly to the right will bring it into contact with the wheel (about Center No. 2). Grind until you have a true radius from the heel to the edge of the teeth, and finish by filing in the usual manner.

HOMEMADE INLAYING TOOLS

A. E. Gray, Stockbridge, Mass.

The two homemade tools shown in the accompanying illustration are extremely useful in doing inlay work on table tops, small boxes, book ends and racks, and other work of this kind. Both can be made without any cost whatever from





scraps and odds and ends found around any manual-training or cabinetmaking shop. One of each kind should be made, as each has advantages in doing certain kinds of inlaying. Occasionally, both are needed on one job. For instance, the tool illustrated in Figure 1 is handier for getting clean-cut, accurate grooves at corners, while the one shown in Figure 2 cuts faster and is more useful where long strips of inlay are to be placed, as in a table top.

In making the groover (Fig. 1) any hardwood will do, such as walnut, maple, oak, etc. A piece ¾ by ¾ in. is shaped as indicated, and a saw kerf is made down its length as shown. The cutter is made from any piece of iron or steel. Square, iron nails are admirable for this. An occasional stroke with a file square across the cutting end will keep it sharp enough. Three or four stove bolts are necessary to keep the cutter A stationary when once adjusted to the proper position. The stove bolt C prevents the piece from splitting. By properly shaping the cutter, this tool can be used as a slitting gauge, fluting tool, etc.

The tool in Figure 2 is made as shown from two small blocks of wood and pieces of hack saws. Block B determines the distance the inlay will be from the edge of the piece being inlaid. It is desirable to prepare a number of these pieces of varying thickness. Holes should be bored at the proper places for convenient changing. Likewise the width of the groove is determined by the number of pieces of saw blades used, all held firmly in position by screws shown at C. In Figure 1, the cutter A determines the width of the groove, therefore a number of these should be made corresponding to the standard inlays used.

The groove should be made slightly less deep than the thickness of the inlay used, leaving some above the surface of the wood for sanding down to a good smooth appearance. The inlay should be coated with a thin, even coat of glue, pressed into position, covered with strips of paper, and clamped, using strips of wood beneath the clamps to insure even distribution of the pressure. The paper prevents the wood strips from sticking to the job and will readily disappear under the sanding process.

Where stain is to be used, the inlay should be given a thin coat of shellac after the sanding process, using a very fine, soft brush. This makes the inlay impervious to the stain, leaving the natural colors of the inlay.

Where a band saw or variety saw is available, very creditable inlay can be made, by gluing together thin strips of different-colored woods which are then again sawed at right angles to the glued faces, after the glue has thoroughly dried. It is not advisable to attempt the more intricate and elaborate designs, as they can be purchased at small cost and will be found more satisfactory. Inlaying presents an excellent opportunity for the boy to add attractiveness to usefulness. It awakens pride and interest on the part of the student, and adds a touch of refinement to plain, severe, and often crude handiwork.

ADJUSTABLE TABLE

F. L. Reynolds

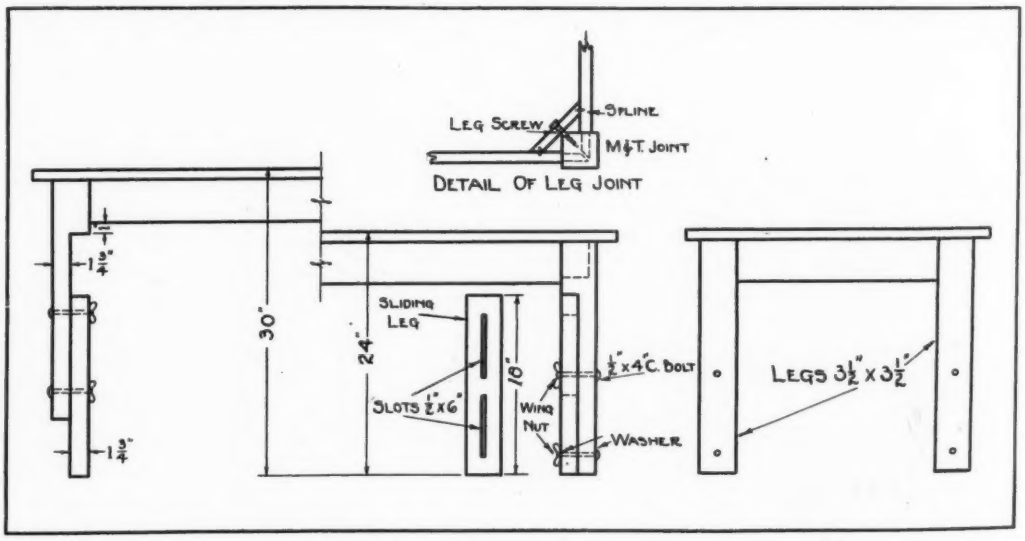
The accompanying illustration shows an adjustable-height table which is used for handwork in grades 1 to 8 inclusive. Since the limits of our space permitted the use of only one set of tables for use in these different grades, this adjustable table was designed.

The table has been found to be very satisfactory and its adaptability to various heights makes it usable for almost any age pupil. This particular set was made with 30 by 72-in. tops.

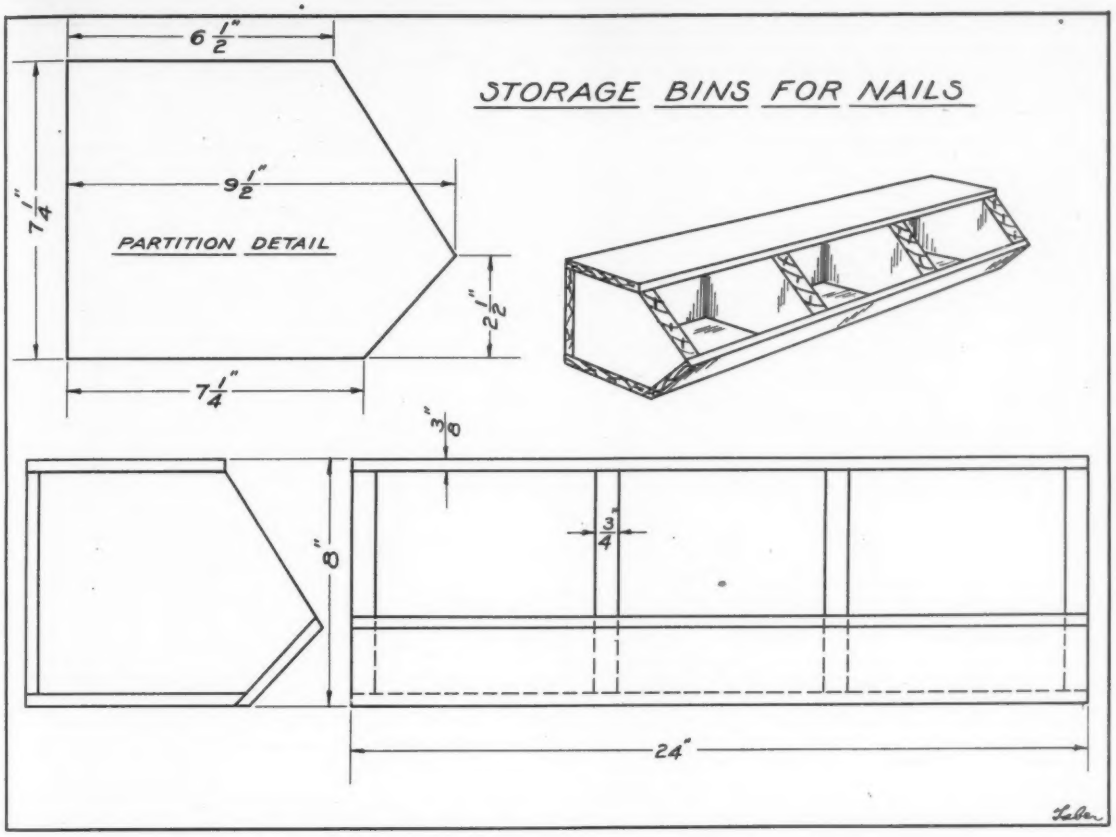
STORAGE BINS FOR NAILS

Jonathan Bright, Erie, Pennsylvania

The storage bins described herewith, were built to afford a convenient and accessible place for nails. They were made to fit a storage cabinet having compartments which are 24½ in. square. Three of these bins, stacked one on top of the other, fills one of these compartments. Anyone desiring to make a set can, of course, change the measurements to suit his indi-



ADJUSTABLE TABLE, DESIGNED BY F. L. REYNOLDS



vidual needs. These bins do not need to be placed in another storage cabinet but can be stacked by themselves.

The construction is simple, consisting merely of cutting up the stock to the sizes shown. The partitions were cut on the universal saw and then the various pieces were glued and nailed together with cement-coated box nails.

JOB TAG

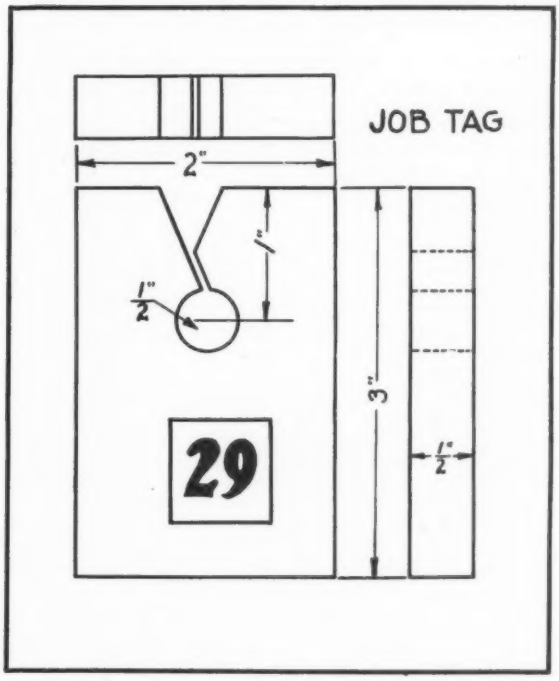
Arthur Feuerstein, Director of Industrial Arts, Rogers Junior High School, Stamford, Conn.

The writer has eliminated much of the difficulty arising from lost pieces by using the job tag which is illustrated herewith. This tag facilitates the passing out of work at the beginning of the period and is also a factor in teaching principles of systematic procedure.

At the beginning of a new term, the making of the tag serves as a good practice and test project to review correct tool operations.

HOW THE JOB TAG IS USED

The job tag is fastened to the job by a rubber band pinched through the saw cut into the ½-in. hole. The rubber bands are made out of old automobile inner tubes that are readily supplied by the boys. It is surprising what such a rubber band can be made to hold.

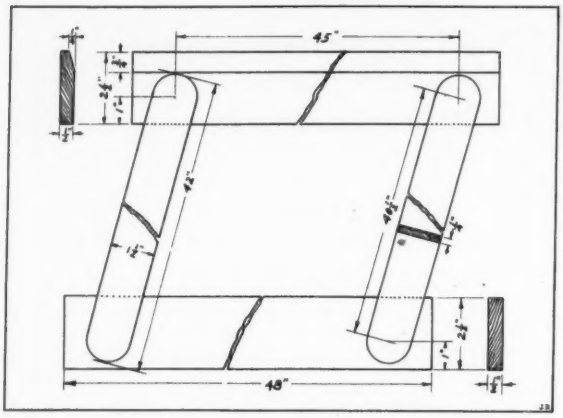


The drawing explains the construction. Numbers from calendars may be glued on and are usually more distinguishable than numbers that have been marked on or painted.

FOLDING PARALLEL RULES

Fred W. Stultz, Indianapolis, Indiana

In making drawings on the blackboard for shop and mechanical-drawing classes, a need is often felt for a fairly accurate means of drawing parallel lines, which is more portable than a straightedge fastened in a slide or on a cord and pulleys. When the instrument herewith described is used for horizontal lines, the lower bar lies horizontally in the chalk trough. The upper bar is supported at the proper height by the instructor's hand.



While there are, of course, no fixed dimensions for an instrument of this kind, the dimensions indicated were found to work very well. However, great care must be taken that the distances between the holes in the mated pieces are exactly the same. A slight variation will not reveal itself when the instrument is extended for the higher horizontal lines, but when it is compressed for the lower the fault becomes quite evident. The top bar was beveled and graduated, in inches and fractions of an inch. The instrument may be assembled with four ¼ by 1-in. stove bolts having their heads countersunk in the backs of the horizontal members.

For vertical lines, a T square, the head of which could ride in the chalk trough, was made. To prevent unsteadiness, the outer edge of the head was cut slightly convex, so a kind of foot was left at each end. The blade of this instrument was also beveled and graduated in inches.

JUMPING STANDARDS

Clifford C. Carlson, Union Free High School, Clear Lake, Wisconsin

Many schools lack funds for buying track equipment. Some of this, however, can be made readily in the school shop.

The following will give you the necessary data for the construction of a very efficient pair of jumping standards:

Necessary Equipment: Electric drill; ¼-in. twist drill; hammer; pipe wrench; screw driver; and automatic drill.

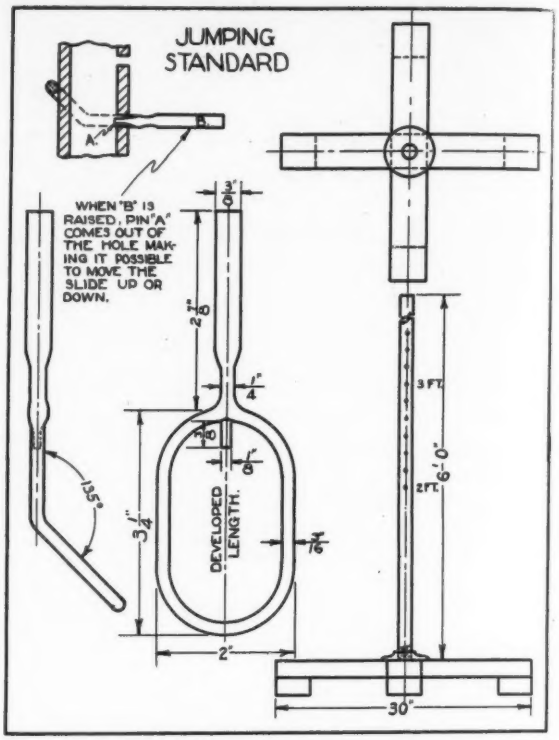
Necessary Materials: Four 1½-in. No. 9 f.h.b. screws; sixteen 10d common nails; eight 5/16 by 2½-in. machine bolts and nuts; eight washers for bolts; two pieces 1½-in. galvanized steel pipe, 6 ft. 6 in. long; (each pipe is fitted with a flange). Lumber: Four pieces 2 by 4, 2 ft. 5 in. long; eight pieces, 2 by 4, 4 in. long; two slides (as specified).

The first step in making the standards is to cut the stock to the specified lengths. Then make cross-lap joints as illustrated. The cross-lap joints are fastened with screws.

The second step is to fasten the feet to the cross pieces.

The third step consists of laying out the holes for the bolts and boring the holes. Use a bit which will bore the holes large enough for the bolts.

The fourth step is to drill holes in the pipes for the slides. In figuring out the height for the first hole, be sure to allow for the height of the base. Start at 2 feet, and at intervals of 2 in. bore holes up to 5 ft., and then between 5 ft. and 6 ft.,



bore holes at intervals of 1 in. Use the prickpunch to mark the holes. After the holes are drilled, the pipes may be fastened to their respective bases. This is done with the bolts called for in the list of materials.

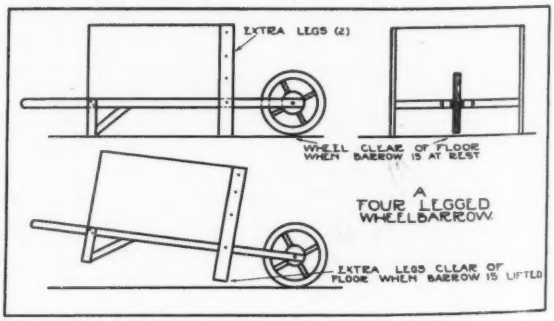
The standards are now complete, except for the slides which can be made in the shop if a forge is available, otherwise a blacksmith can do the work. The slides are to be made according to the illustration. The pin, which is marked A, must slide into the hole which is drilled into the upright. Whenever it is necessary to move the slide, the part which projects must be raised, and then the change can be made.

These jumping standards are not clumsy and will be found to be very satisfastory.

A FOUR-LEGGED WHEELBARROW

H. Moore, Hamilton, Ont., Canada

A very decided improvement to any wheelbarrow, whether used in a factory or around the school, is a couple of auxiliary legs secured to the front as shown in the sketch. The box form of wheelbarrow is best adapted for this idea and when properly made it is well worth the time spent. The object aimed at is to have a solid wheelbarrow that will not slide so easily when it is being loaded, especially on a concrete floor. It may be seen that the extra legs made from two lengths of 1 by 2-in. hardwood raise the wheel from the floor when the barrow is in standing position, but when the handles are lifted the auxiliary legs clear the floor.


EXTRA LEGS (2)
WHEEL CLEAR OF FLOOR WHEN BARROW IS AT REST
A FOUR LEGGED WHEELBARROW
EXTRA LEGS CLEAR OF FLOOR WHEN BARROW IS LIFTED

A DRAWING-SUPPLY LOCKER

Robert E. Murray, Fremont High School, Fremont, Ohio

The locker described herewith was designed to occupy a minimum amount of space, and yet allow all of the equipment to be so arranged that a moment's glance is sufficient to check whether everything is in its proper place.

It may be hung on a wall in an accessible place. It is only 3½ in. in depth, and when well made, adds to the attractiveness of the room.

The rails in front should not be so high so as to obstruct a view of the tools. All students must be instructed to place their triangles in front of the textbooks.

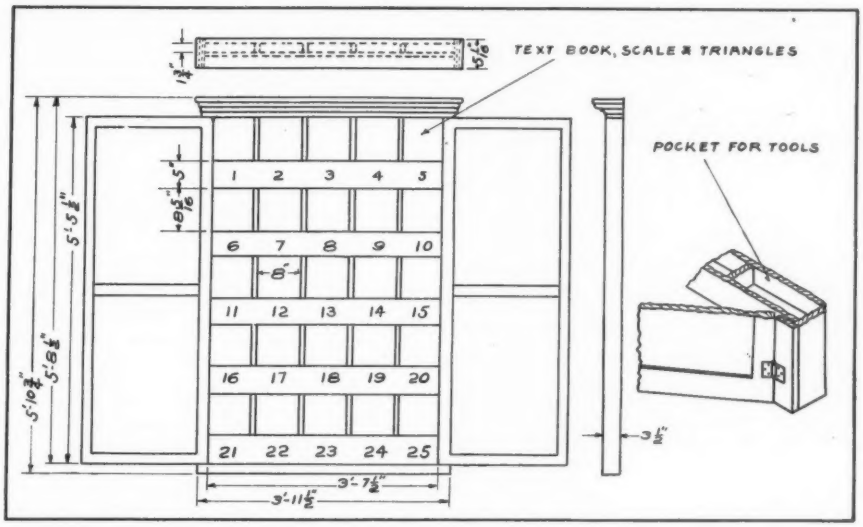
We do not supply the students with drawing sets, therefore no provisions have been made for them. With a few alterations, however, the locker might be made to take care of them, too.

Each tool is marked to correspond with the number on the rail, and a tabulated chart is posted on the inside of the door so that each student knows to what number and table he has been assigned.

This locker contains 25 divisions to meet our own particular need, but this number may be increased with little trouble. The locker makes a splendid project for a woodworking class.

Bill of Material

2	pc.	¼ x 20 x 65	Doors, 3-Ply Spruce
22	pc.	½ x 3½ x 47	Ceiling Boards for Back
5	pc.	½ x 5 x 43½	Horizontal Rails
6	pc.	½ x 1¾ x 65½	Vertical Separators
1	pc.	½ x 5½ x 48	Top
25	pc.	½ x 1¾ x 8½	Bottom Shelves
4	pc.	½ x 2½ x 70	Hinge Strips
1	Quarter-Round, 47½ in. for Front		
2	Quarter-Round, 5 1/16 in. for Sides		
6	Hinges		
2	Door Clasps		
1	Lock		

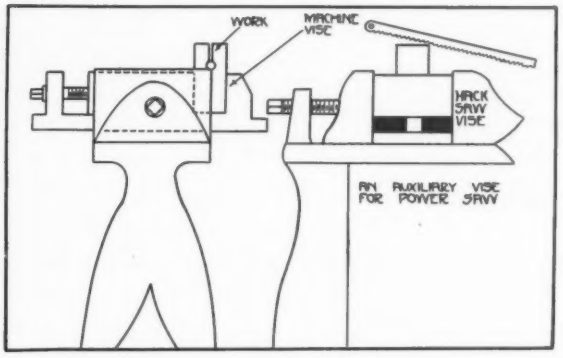


DRAWING-SUPPLY LOCKER, ROBERT E. MURRAY, FREMONT, OHIO

AUXILIARY HACK-SAW VISE

H. Moore, Hamilton, Ontario, Canada

A power hack saw is usually looked upon as a single-purpose machine, yet it can be made to do very creditable saw-slitting jobs by simply using an extra vise as shown in the drawing. I have used this emergency method myself and find that the best vise to use is the one with the bolt slots on the ends. With a vise of this kind it is possible to get a good grip on the flat sides. The sketch shows an example of the kind of work done, but there might be numerous other jobs that will occur to readers whereby the power hack saw can be made to serve in a capacity other than that for which it was originally intended.



THE AUXILIARY HACK-SAW VISE IN USE

SETTING MACHINERY

U. L. Hiatt, La Junta, Colorado

Usually the school shop is not planned with the idea in mind that at some future time heavy machinery with speeding gears, knives, and wheels will be placed on the floor. The floor of the shops are usually built of wood, with the floor joist resting on concrete blocks and the subfloor laid on them. The hardwood floor, usually yellow pine or Douglas fir, giving the base for any machinery. Anyone who has had any experience with machinery thus placed will welcome the chance to set them on a cement base. In the illustrations the dimensions for the setting of a band saw are used.

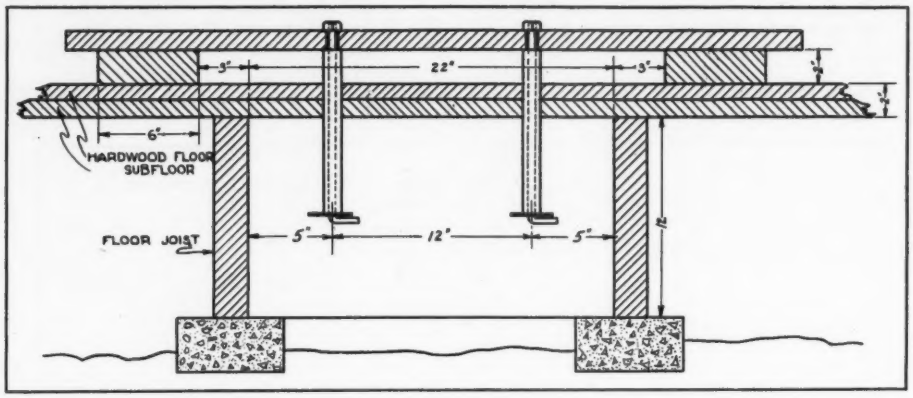


FIG. 1

The first step in placing the machines is to consider the type of work that is to be done on them and then arrange them so that the different processes will come in their proper order. When this condition has been met, lay out a suitable space on the floor where the machinery is to be placed. Cut the flooring out and head in between the joists with the same material of which the floor is made. Care should be taken to see that all headers and short joists are well supported so that the floor will not settle and leave the block of concrete standing above the floor level.

When this has been accomplished make a correct measurement of the holes in the base of the machine, and make a frame as shown in Figure 2, being certain that the holes are exactly in the same position as they are in the base of the machine. You will notice by referring to Figure 1 that 2-in. blocks raise this plane above the floor. The advantage of this is that one is able to finish all the surface of the cement. This frame should be so placed that the distance from each hole to the floor joist is the same. See Figure 2 and note that this distance is 5 in., in this case.

Of course, the diameter of the bolts used will be determined by the size of the hole in the base of the machine. The bolts should be of sufficient length to reach well into the middle of the block of concrete. Either machine or carriage bolts, or rods bent may be at right angles at one end and threaded at the other as shown in the illustration, may be used. On each bolt is placed a very large washer or a strap of iron to keep it from pulling out of the concrete. I have found that in poring the concrete it is quite difficult to maintain the exact location of all the bolts. So I suggest that you prepare some cylinders of black iron of about the weight of stovepipe material. Cut this black iron into strips 3 in. wide and long enough to fit between the washer and the frame as shown in Figure 1. Hammer these strips into the form of a cylinder by using a 1-in. gas pipe and a mallet or hammer. To do this clamp the pipe and one side of the black iron into a vise and then hammer the metal down over the pipe. By repeating this a few times, the sides of the iron will be brought together

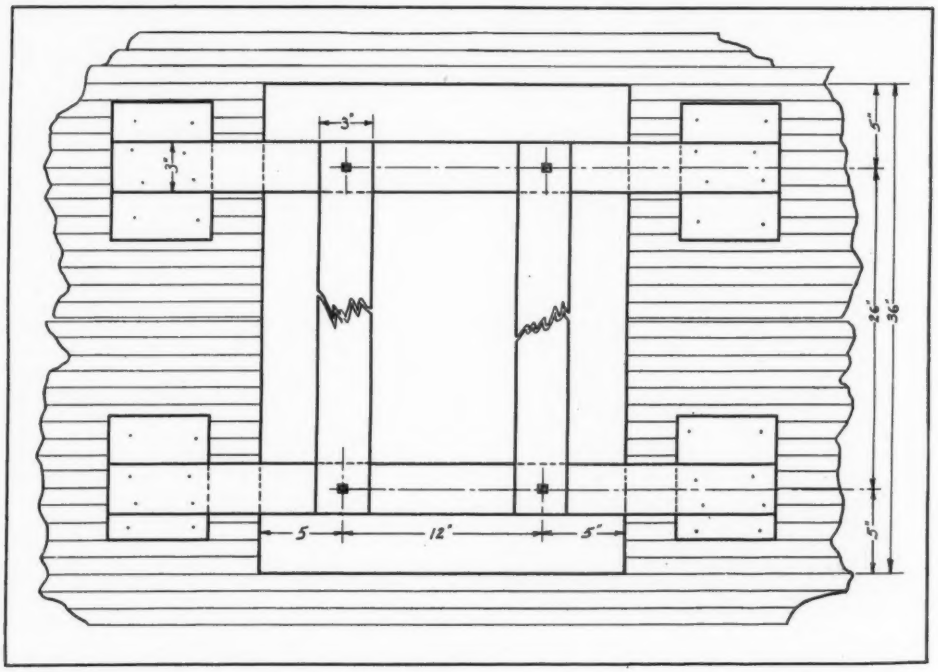


FIG. 2

making a cylinder or tube. Place the cylinder on the bolt, and after putting the bolt in position screw the nut down tight enough to make the bolt rigid.

We are now ready for the concrete which should be made only of clean sand and gravel, and cement in the proportion of 6 to 1. Just enough water should be used to make a good mix. As the place is filled it would be well to have some No. 10 wire bent and placed in the corners outside the bolts. Many people make a mistake in working concrete by waiting too long to put on the top or finish coat. This should be done within thirty minutes. The top coat should be of a mixture of 2 parts sand and 1 part cement. Work this coat down first with a wooden float, and as it sets use a steel trowel. A little water sprinkled on the cement with a brush will aid in bringing the surface to a fine finish. A little care here will be a source of pride in the future. The cement should be covered with wet sacks, wet sawdust, or wet sand to prevent any crack from developing, which would lessen the value of the block for the purpose for which it was intended. Give the block 8 to 10 days to thoroughly dry before attempting to place the machine on it.

When the frame supporting the bolts has been removed, take a pair of wire pliers, and by taking hold of the inside edge of the iron cylinders, twist it around the bolt and at the same time remove it from the cement. You will find the bolt may be moved around in this hole very freely. Now this is just what we wanted to happen so we could set them at exact distances.

There are various materials used in filling this hole, such as lead and a very rich mixture of cement and sand. However, the very best that I have ever used was ordinary sulphur. By melting the sulphur and poring it into the hole we get a perfect anchorage. Set bolt No. 1 as nearly perpendicular as possible. Establish the position of the other bolts by measuring 12 in. first and then 26 in. By careful work you should get the exact measurements of holes in the machine. The sulphur will set almost as soon as you pour it into the hole, so you need not wait now to move the machine into place.

If your rollers are not large enough for the base of the machine to clear the bolts, use a 2-in. plank. This plank is to be used on top of the rollers. By using a pinch bar, the machine may be easily moved into position and thinner blocks may be used to let it down into place.

Every machine will run and work better if set level. Your shop floor may not have been level, but now you may level the machine by using metal shims under it near the bolts.

Whenever metal or wood must be fastened into cement, this method will be found very practicable and efficient. You will find that the sulphur will set before the wood has time to swell.

A HOMEMADE BELT SANDER

Charles W. Frost, Albany, Oregon

This hand-block belt sander was built early in December, 1924, to facilitate the sanding of seats which the high-school manual-training classes were asked to make for the gymnasium balconies. It has proved to be quite satisfactory.

The construction of the machine is clearly shown by the photographs, but the following specifications may interest prospective builders. Most of the dimensions given may be changed to conform to conditions, needs, space, or power available.

Specifications

Shafts—1 7/16 by 36-in. cold-rolled steel.
Pillow blocks—cast iron, babbitted, and fitted with grease cups.
Sand-belt pulleys—cast iron, 6-in. face, 18-in. diam.
Motor pulley—4-in. face, 4-in. diam.
Motor—3-h.p., 1,850 r.p.m.
Length between centers of sand-belt pulleys, 10 ft.
Height of top lap of sand belt from floor, 36 in.
Width of sand belts, 4 in.
Sliding table—30 by 72 in., slatted top.
Total cost exclusive of student labor, $37.15.

The frame was mortised and pinned together, and fastened to the floor with ⅜ by 8-in. bolts set in cement.

The uses of the belt sander are so many and varied that it is impracticable to describe them all here, but the three illustrated will doubtless suggest others as required for the solution of problems as they arise.

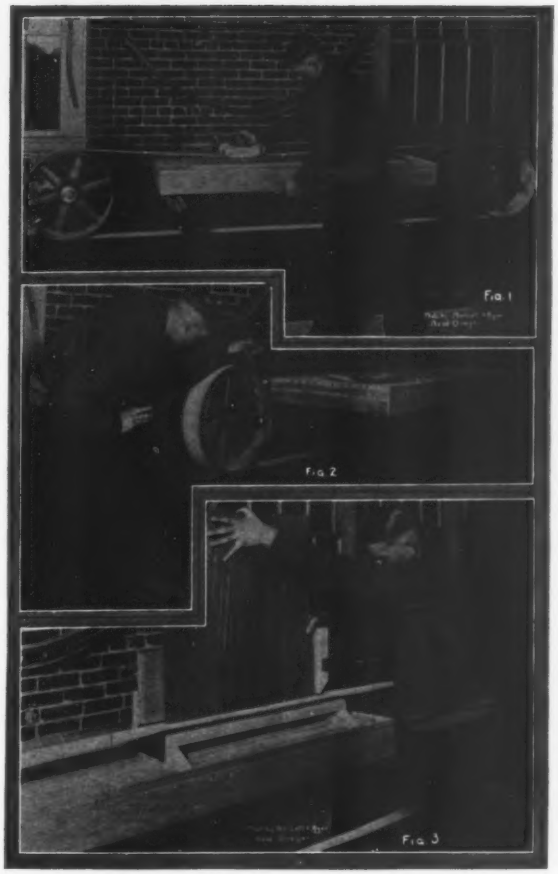


Figure 1 shows a student who is sanding a table top. The sand belt is running, canvas side up, *under* the hand block and *over* the table top. The operator is moving the sliding table slowly back and forth to prevent the edges of the belt cutting into the wood and leaving marks.

Figure 2 illustrated one way of sanding concave surfaces, such as chair rails and legs. This is not as satisfactory as the factory method of using special jigs or forms for such operations, but answers the purpose where but a few pieces of a kind are to be finished. The sand belt is seen with its canvas side toward the pulley.

Figure 3 shows a common form of jig used in connection with the belt sander to smooth the end grain. The sand belt is running with the canvas side toward the pulleys.

The closed-in part of the sander frame contains storage lockers which open toward the wall.

The open space at one end will accommodate the motor when one especially for the sander is obtained. (Because of a mistaken idea that the sander would be used a comparatively small amount of the time, it was decided to drive it from the band-saw motor. A separate motor should be used if it is possible to obtain one.)

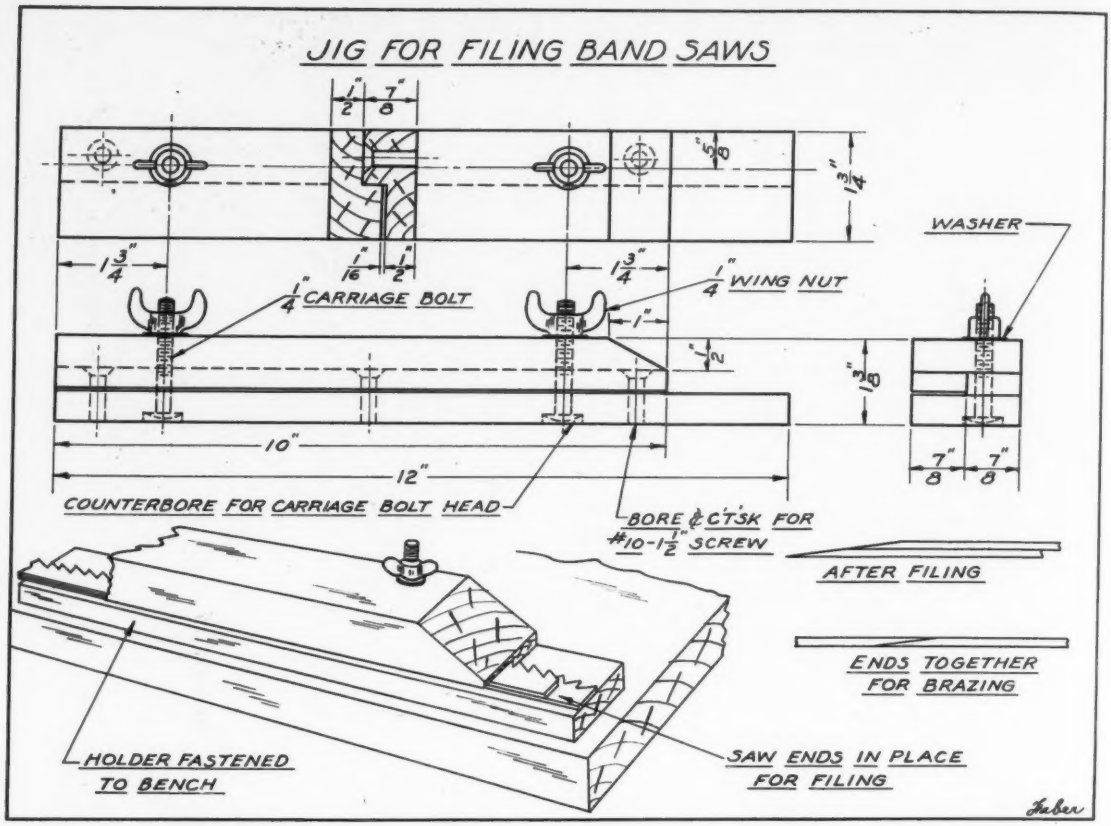
The canvas-backed sand belts used are purchased in 50-yard rolls and glued up as required. Special belt-lacing dies which cut adjoining ends to dovetail together can be purchased from any maker of belt sanding machines, but quite satisfactory results are obtained by cutting the ends at an angle and gluing them together with a narrow canvas backing strip.

Where a motor of sufficient horse power is available it would be preferable to adopt sand belts 6 in. wide.

A CLAMP FOR FILING THE JOINT ON BAND SAWS

Jonathan Bright, Erie, Pennsylvania

In brazing broken band saws one of the chief difficulties seems to be to file the ends so as to make a perfect joint when the braze is completed. The writer experienced this difficulty



and used various makeshift devices for many years, but finally developed the clamp shown.

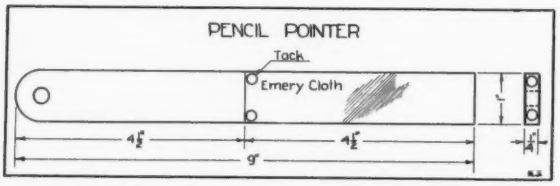
It consists of two pieces of hardwood, held together by two ¼-in. carriage bolts with wing nuts. The carriage bolts are put in place in the lower piece, which is fastened with screws to the front edge of the service bench. The top piece is then slipped over the carriage bolts and the wing nuts are screwed down.

To use the clamp, the two ends of the saw are brought together and placed in the clamp, as shown in the perspective view. The lower end is extended the amount of the lap past the upper end. Then the wing nuts are tightened securely. The saw ends are then filed in this position. If the filing is carefully done, this should make a perfect joint.

PENCIL POINTER

Raymond Johnson, Central High School, Tulsa, Oklahoma

The pencil is a very important tool in mechanical drawing, and it must always have a well-pointed lead to insure accuracy. As an improvement over the pointer pad, the writer devised this pencil pointer to be suspended by a picture wire from the front left side of the drawing desk. The messy powdered lead drops to the floor and does not soil the fingers or drawing equipment.



The pencil pointer is made of scrap plywood to which is glued and tacked a 1 by 9-in. strip of emery cloth, making a double-faced pointer which will last for several years. The tacks were found necessary, as the ends of the emery cloth usually peel off after long use.

BINS FROM OLD DESKS

Arthur Feuerstein, Director of Industrial Arts, Rogers Junior High School, Stamford, Connecticut

The superintendent of buildings presented the industrial-arts department with a number of old desks that had become antiquated. As a rule there is very little usable material on desks, much of it being metal or curved wood.

These desks, however, were of the type that have a top which lifts and serves as a cover. By attaching two cleats on each side so as to allow clearance for the cover and then fastening three or four desks between four vertical strips, a handy set of bins resulted.

These bins are used for sand, cement, lime, etc., in the concrete-working section of the shop, and for wiring devices and wire in the electrical section of the shop.

OLD DESKS CONVERTED INTO BINS

FINISHING BENCH

C. M. Jochem, Jr., Pompton Lakes, N. J.

A practical finishing bench for the shop seems to be quite a problem to most instructors. The bench described herewith was made in my ninth-grade classes two years ago. It has been found very practical and worth while, and the present time still finds it in a neat and clean condition.

The bench is made of cypress and given a natural finish.

Zinc makes a very practical covering for the top, although any sheet metal may be used.

The shade is made the desired length by splicing two rollers together. Cards above each compartment designate the places for the various finish and brushes. Pint jars are used with glass top for paints, and screw caps for stains, and for brushes. The brushes are suspended in turpentine through a hole in the top of the screw cap. This keeps the brushes in a good condition.

When a boy is ready to do any finishing, the first step is to cover the top of the bench with newspaper which is kept on a rack nearby. This done, he takes from the top row of jars, the desired stain, and places it on the bench. The shade is then pulled down, thus covering the front of the finishing compartments and protecting it from being spattered with stain. The stain and brush are kept in the same jar. Spirit stain makes this possible. If he wants to use paints, the paint is kept in the center row of compartments and directly below each color is the corresponding brush. The boy takes out both the paint jar and the jar in which the brush is kept. The habit of mixing brushes is thus overcome, as the boy cannot help but put the paint and brush in its proper place as only the right compartments are vacant at the time.

It is best to paint the outside of the jar with the color of its contents, also paint the jar in which the brush is kept. Paint the name of the stain on the jar, as a safety against any possible doubt of the contents.

When the boy has finished his job, he raises the shade, replaces his finishes, and paints, or brushes, and rolls up the newspaper which he has used. The paper must be placed into a metal container to reduce fire hazards.

When finishing large projects on the floor, the floor should be covered with paper and the shade beneath the top of the cabinet should be pulled down to protect the front of the bench.

Observing these rules will keep the bench top spotless, and the bench itself clean. The cabinet thus helps to add to the appearance of the shop, by its neatness.

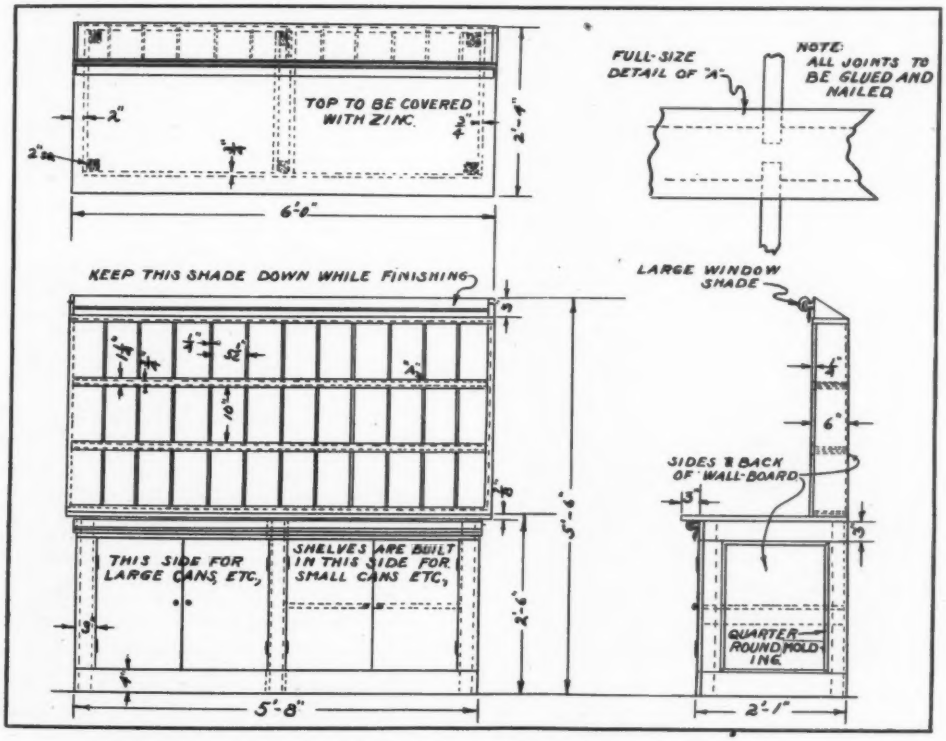
The lower part of the cabinet is used for finishing supplies.

THE DROP DISPLAY RACK

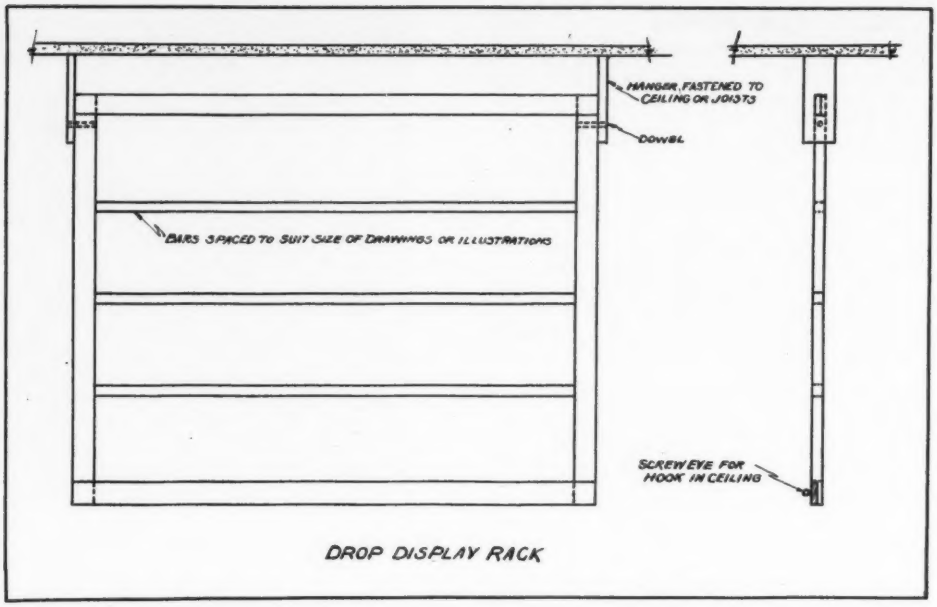
L. W. Kunkle, Cheltenham Township Schools, Elkins Park, Pennsylvania

The shop with enough display or bulletin-board space is rare. In the general shop, or any shop where one or many activities are taught, the same drawings or illustrations are not used for all activities. It is often desirable to remove those on display and show others in their place with little interruption. The drop display rack serves well for this purpose.

It should be hung near a side or end wall where it can be easily seen by the students. A screw eye and hook may be used to hold the rack up when it is not in use.



FINISHING BENCH DESIGNED BY C. M. JOCHEM, JR., POMPTON LAKES, N. J.


HANGAR, FASTENED TO CEILING OR JOISTS
DOWEL
BARS SPACED TO SUIT SIZE OF DRAWINGS OR ILLUSTRATIONS
SCREW EYE FOR HOOK IN CEILING

DROP DISPLAY RACK

When the woodwork class needs a certain group of drawings or illustrations on construction, the proper rack can be easily dropped for immediate use. When they are through with their work, the display board can be quickly swung back and fastened into place.

Try this teaching aid in your shop and you will soon discover its usefulness.

THIS MONTH'S COVER

In the picture on the cover of the August issue of the INDUSTRIAL-ARTS MAGAZINE, the artist has shown in an able manner an old-time cobbler at his work. Near the window of the room in which the cobbler is working, may be seen a glass bottle filled with water. The purpose of this bottle was to diffuse the light and thus illuminate the work on which the cobbler was working.

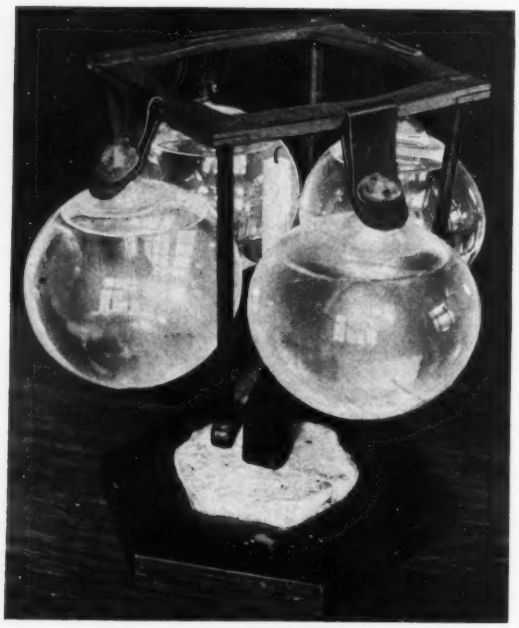


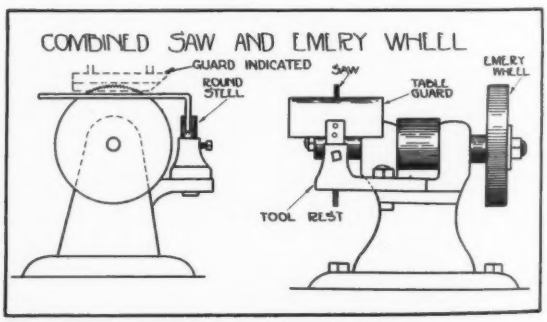
Photo by Keystone View Co., Inc., New York City.

The above illustration shows a curious arrangement of four of these water bottles which diffuse the light of one candle, probably so that four workmen could gain the full benefit of the single candle. This old relic was brought from France.

COMBINED SAW AND EMERY WHEEL

H. Moore, Hamilton, Ont., Canada

A circular saw is a handy part of the shop equipment for cutting up sheet copper and brass. An arrangement that will be of interest to those not in possession of a machine for this purpose is shown in the drawing. One end of an ordinary grinder has been equipped with a sheet-steel table. The steel is bent at right angles and let into a short piece of bar steel where it is pinned in place. The assembled fixture is held in the toolrest as shown. The saw is mounted on the spindle with



a collar at each side. A suitable guard should be placed over the saw to avoid accidents.

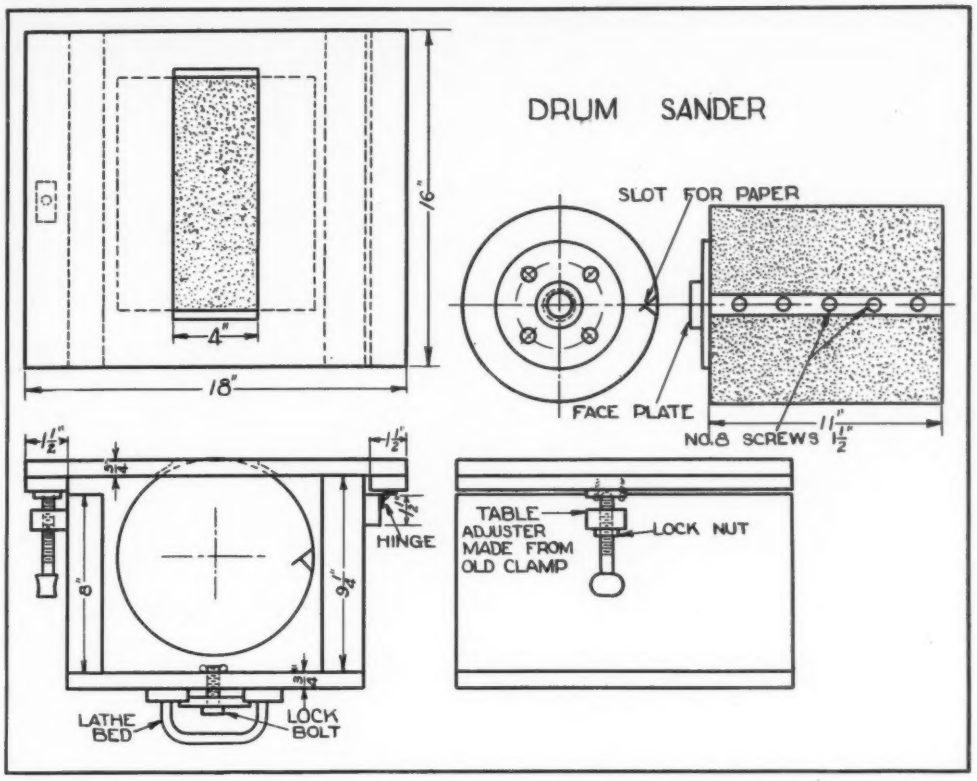
DRUM SANDER

W. S. King, Enid High School, Enid, Oklahoma

Most small shops are handicapped in their work because they do not have a sanding machine.

The sanding machine described herewith is inexpensive and can be constructed in a very few hours. This sander is designed to be attached to a lathe; however, if one had a small motor the drum could very easily be attached to the motor. The sander does not interfere with the use of the lathe, because it can be removed and replaced in about two minutes.

The drum is made up of 13 pieces of white pine 13/16 in. thick. These pieces are glued and nailed together and then, after attaching the faceplate, the drum is turned down to 9½ in. in diameter. It is best to stretch two thicknesses of cloth around the drum before the sandpaper is put on. The sandpaper can be purchased at a very small cost at a local planing



mill. I find that this type of sander serves the purpose very well, and turns the drudgery of sanding into a pleasure.

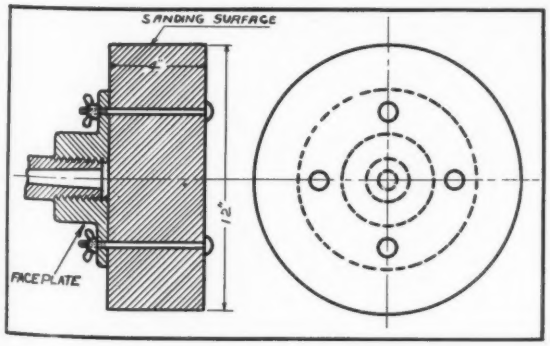
Bill of Material

1	pc.	1	x 16 x 18	Top
1	pc.	1	x 16 x 18	Base
1	pc.	1½	x 16 x 8	Front
1	pc.	1½	x 16 x 9¼	Back
3	pc.	1	x 1½ x 16	Cleats
2		3-in. Butt Hinges		
30		1½-in. No. 8 f.h. Screws		
1		½-in. bolt 2½ in. long with Wing Nut		
		Cylinder, 10 in. diam. x 11 in. long.		
		Faceplate		

A POWER SANDER

C. R. Lindstrom

In a high-school shop where a power sander is not available as a part of the school equipment, an excellent substitute may be made if the shop is equipped with a wood-turning lathe.

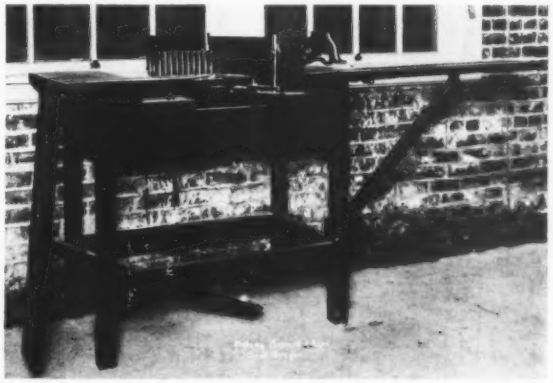


This sander is quite useful and efficient for small work. The illustration shows how it is constructed. The disc may be removed from the faceplate in just a few minutes by loosening the thumb screws.

A MITER-SAW TABLE

Charles W. Frost, Albany, Oregon

The table, which is shown in the accompanying illustrations, shows a most satisfactory solution of the problems involved in using the miter box.

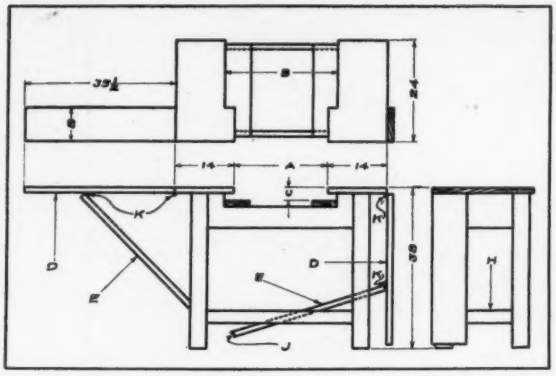


The material to be cut is supported by the table top and its folding leaves, DD, upon the same level as the top of the miter box, thus eliminating the makeshift arrangements usually devised for this purpose.

Space A is governed by the length of the miter box, and C by its depth. Space B should be just wide enough to insure the inside edges of the table being cleared by the end of the saw when the guides are in their extreme right and left positions.

Explanation of Drawing

A—length of miter box.
B—width of opening required for clearance of saw.
C—depth of miter box.
D—folding table leaves.
E—folding leaf brackets.
H—lower rails of table upon which the ends of the brackets are held by the notches J.



J—notches in the ends of leaf brackets.
K—strap hinges.

Bill of Material

4	pc.	3½ x 3½	x 36½
2	pc.	1½ x 8	x 54
2	pc.	1½ x 8	x 36
4	pc.	1½ x 8	x 22
2	pc.	1½ x 4	x 54
2	pc.	1½ x 4	x 40
2	pc.	1½ x 4	x 22
2	pc.	1½ x 24	x 14
3	pair	6-in. strap hinges	

TRAY FOR DRAWING INSTRUMENTS

L. D. Fullmer, Metropolis, Illinois

In our shop we require each pupil to draw a plan of whatever project he works on, as is customary in most shops. But after the semester has started, pupils will progress at varying rates of speed, so that there may be some pupils doing drawing and some doing woodwork, at the same time. To facilitate the handling of drawing instruments under these circumstances, the accompanying set of trays were worked out.

Each tray contains a 12-in. rule, one 2H and one 4H pencil, four thumb tacks, one eraser, and one pencil compass. The tray has been divided into little compartments to fit each article, so that there is a place in it where each item is to be kept. It is an easy matter to see that all supplies are on the tray when it is issued to the pupil, and also easy to see that they are still all there when the tray is returned. This system is much more efficient than that of passing out materials "helter skelter," or otherwise.

In our shop we teach drawing in the same room in which the woodwork is taught. We place the drawing boards on the woodworking benches and proceed. A drawing board is kept on the side of each bench. The little rack for holding eight of the trays is very helpful in passing out the trays rapidly. The person passing out the trays is held responsible to see to it that all trays are O.K. at all times.

Hold Seventeenth Annual Vocational Conference

The Seventeenth Annual State Vocational Conference of Pennsylvania was held June 27 to 29, at Eagles Mere Park. Mr. L. H. Dennis acted as chairman of the general session.

The conference was divided into groups for teachers and supervisors of home economics, industrial education, agriculture, continuation schools, and vocational schools, the department of labor and industry, and the staff of the bureau of rehabilitation.

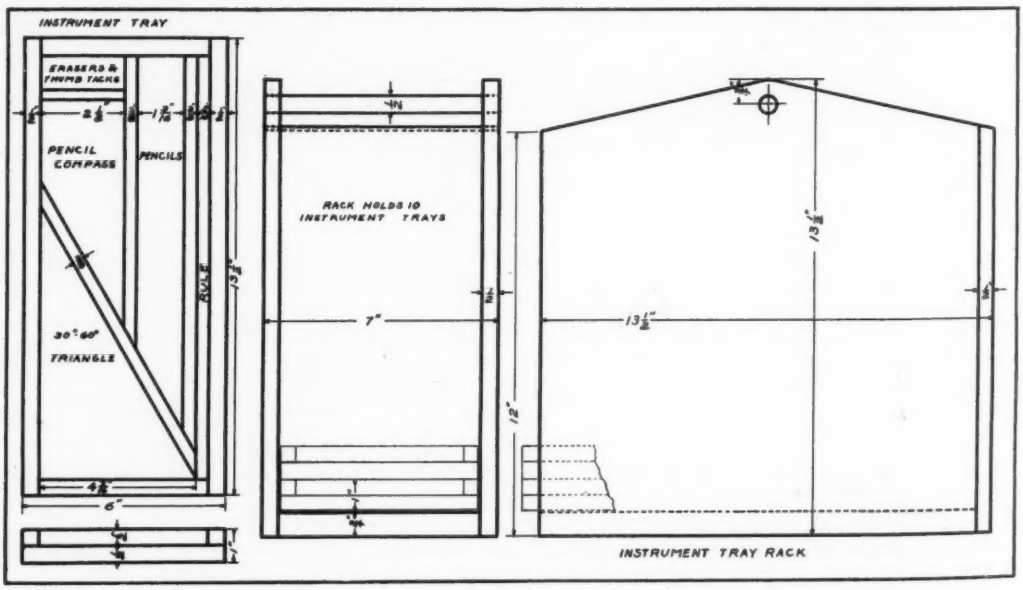
At the general session, Mr. J. A. Morrow of Bradford county, discussed "Problems Incident to the Development of Vocational Education in Rural Communities," and Mr. M. D. Proctor of Uniontown, Pa., talked on "Some Phases and Problems in Practical Arts."

At the home-economics session, Miss Helen R. Rischel of Lebanon county, talked on "Scoring for Qualities of Leadership"; Miss Margaret Glossner of West Chester, discussed "The Broadening of Interpretation of Home Management to Fit Modern Life"; and Miss Emma M. Watts of Pittsburgh, took for her subject, "How Home Economics Can Be Made to Function for the Adolescent Girl."

At the industrial-education session, Dr. G. D. Whitney of Pittsburgh, talked on "Problems of the Curriculum"; Mr. C. W. Sylvester of Baltimore, Md., discussed "Methods and Contents of Related Subjects in Vocational Schools"; Mr. M. M. Walters of State College, Pa., took the subject, "Present Practices in Related and Nonvocational Subjects in Pennsylvania"; Mr. G. A. McGarvey of Washington, D. C., discussed "Methods of Follow-up with Vocational Graduates"; and Mr. G. H. Parkes of Williamsport, talked on "Cooperative Education Made Convenient to Industrial Students and Teachers."

At the industrial-arts session, Mr. W. T. Elder of Slippery Rock, talked on "Industrial Arts for the Small Community"; Mr. W. E. Steiner of Sunbury, discussed "The Possibilities

(Continued on Page 22a)



Don't try this with any screw driver except the new Stanley 100 plus

"BUILT TO STAND ABUSE" is the best description of this new Stanley Screw Driver.

It will stand being hammered. The tip is tough enough to cut iron rivets, screws or nails without fear of damage. It can be used for prying. The tip can be resharpened with a file—thus eliminating the tendency to draw the temper on a grinding wheel.

You can certainly use screw drivers like these in some of your shops. Even though you may not subject them to these tests of strength, nevertheless this built-in quality gives you a safety factor that means long life and service.

The "One Hundred Plus" screw driver is scientifically constructed. It has a forged steel blade, tempered its entire length. Tough hickory handle is capped with leather.

Recommended for use in your electrical, automobile, sheet metal and machine shops—anywhere that a real rugged screw driver is required. Made in 4 sizes: 4"-5"-6" and 8" blades.

THE STANLEY RULE & LEVEL PLANT
Educational Department
New Britain, Conn.

STANLEY TOOLS

Stanley Equipment is Standard Equipment

STANLEY TOOLS

Points on Drill Grinding

Putting a proper point on the business end of a twist drill doesn't sound hard—but the fact is that 11 pages, or practically 25% of the "Handbook for Drillers," are devoted exclusively to this all-important thing. In reality pointing a twist drill is a delicate piece of work calling for great skill, and much advance knowledge.

If you would like copies of the Handbook for the use of students in machine shop practice, we shall be glad to send them to you, without charge, in any reasonable quantities.

The CLEVELAND TWIST DRILL COMPANY CLEVELAND NEW YORK-CHICAGO-LONDON SAN FRANCISCO

TRADE MARK REG. U. S. PAT. OFF. AND FOREIGN COUNTRIES

(Continued from Page 324)

of Industrial Arts in Foundry Practice"; Mr. S. L. Coover of Beaver Falls, took the subject, "A Score Sheet as an Aid in Evaluating Industrial-Arts Projects"; and Miss A. Adele Rudolph of Philadelphia, discussed "Industrial Arts in the Lower Grades."

At the vocational session, Mr. Henry Klonower of Harrisburg, talked on "Evening-School Certification Requirements."

At the woodworking session, Mr. H. D. Immel of Harrisburg, talked on "Safety Instruction"; Dr. F. T. Struck of the State College, discussed "A Common Language"; and Mr. J. G. Spafford of Trenton, N. J., took the subject, "Teaching Ideals and Attitudes."

MR. BOWMAN TO CONNECTICUT

Mr. Ernest L. Bowman, of Columbus, Ohio, was recently appointed state director of trade and vocational education in Connecticut, to succeed Mr. F. J. Trinder who has resigned.

MR. ERNEST L. BOWMAN
State Director of Trade and Vocational Education, Hartford, Connecticut

Mr. Bowman was educated in the public schools of Pennsylvania and was graduated from Teachers College, Columbia University, and from the Pennsylvania State College. He has been a high-school principal, an instructor in the state college, a state supervisor of industrial education, and director of vocational education in city schools. He was for four years instructor in industrial education in the Pennsylvania State College, director of trade education in Erie, Pa., and director of educational work for the plumbing and heating bureau. Recently he had acted as educational director for the National Clay Products Extension Bureau in Columbus. During part of the past year he has been enrolled as a graduate student in vocational and industrial-arts education at the Ohio University.

Mr. Bowman brings to his new position considerable experience as an author and editor. He prepared the standardized course for training apprentice plumbers, and he was responsible for the preparation of a number of pamphlets for plumbers.

He is the author of the vocational surveys at New Castle and Johnstown, and is joint author of one conducted at McKeesport, Pa. He also is a frequent contributor to professional periodicals.

(Continued on Page 24a)

Department of Industrial Arts
Pittsburg Senior High School
Pittsburg, Kansas

April 3, 1929.

Yates-American Machine Co.,
Beloit, Wis.

Gentlemen:

In response to your circular letter of March 1929 concerning your "B-4 Single Surfacer". It has been my privilege as a school man and as a journeyman in the cabinet shops to inspect and use a variety of surfacers. It is the most compact JOB that I have ever had the pleasure of inspecting. It is a machine that any instructor would be glad to have in his shop.

Yours truly,

H M Williams

THE unsolicited letter printed here is indicative of the manner in which the B-4 is received by instructors everywhere. It IS the best moderate priced single surfacer available for school use.

It is compact, strongly built in every detail so that it will stand hardest usage and is safe for the most inexperienced to operate. And it performs like the largest and highest priced machines. Let us send you full information on the machine "that any instructor would be glad to have in his shop."

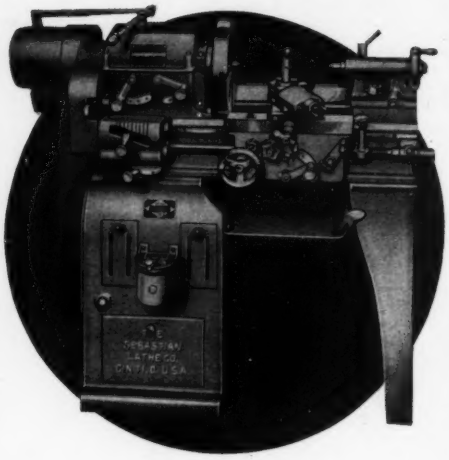
YATES-AMERICAN MACHINE COMPANY

Vocational Division
BELOIT, WIS.

SEE OUR DATA IN BRUCE'S SPECIFICATION ANNUAL 1929 EDITION

New Lathes *for* Next Fall's Classes

If they are bought on these specifications you are ASSURED of ABSOLUTE SATISFACTION



(....) Lathes Gold Seal or equal—Swing 11", bed length 4', to be 8 speed geared head, full quick change box with no loose gears, to cut threads 6-96, feeds .00175 to .111, all steel gears, 1 1/16" hole through spindle, collet capacity 7/8", bearings of main spindle 2 1/16x2 3/4—1 11/16x2 1/4", to be taper gibbed throughout, motor drive with motor fitted in leg under headstock with a tool cabinet in the leg below the motor compartment, tumbler yoke for cutting left-hand threads with the depth of the teeth already adjusted on the quadrant for throwing over to a left-hand thread, lathe to be bronze bushed wherever required. Macit tool post screw. Silent chain drive with easy adjustment for stretch in the chain, lathe to be fitted with a safety shearing pin, graduated compound rest and tailstock bases, tailstock center oiler, friction type collars on compound rest and cross feed with these collars graduated, accuracy alignment test .0005, motor and control to be (Specify here type current and type of control wanted). Each lathe to be furnished with a chip pan, depth thread chasing stop, centers, thread chasing dial, steady rest, and wrenches. The lathes shall all be furnished with all gears guarded by cast iron guards, and the operation of the lathe for stop and start shall be through a friction on the headstock controlled by a lever within easy reach of the operator so that the motor can run constantly when machine is in operation. The apron of the lathe shall have a safety device to prevent both longitudinal feeds being thrown in at the same time.

Add here list of extras wanted such as, Chucks, Taper Attachment, Draw-in Attachment, Collets, Tools, Dogs, etc.

Tell us your lathe requirements. We will be glad to send literature on Sebastian Gold Seal Lathes

THE SEBASTIAN LATHE CO.
CINCINNATI, OHIO
NEW YORK OFFICE - Room 372 - 50 Church St.

(Continued from Page 22a)

MR. BALLENTINE BECOMES SUPERVISOR OF APPRENTICES AT NEWPORT NEWS, VA.

Mr. Linscott Ballentine, formerly assistant supervisor of trade and industrial education for Virginia, has accepted a position as supervisor of apprentices in the Newport News Shipbuilding and Dry Dock Company.

MR. LINSCOTT BALENTINE
Supervisor of Apprentices, Newport News Shipbuilding and Dry Dock Company

Mr. Ballentine, who had been connected with the state vocational board in the capacity of director of foremanship and industrial teacher-training work, had conducted a number of conferences for the improvement of foremanship in more than a hundred industries of the state. During his six years of service for the state, Mr. Ballentine had effected a reduction in accidents, an increase in production and a reduction of breakage and spoilage, which has brought about better relationships between employer and employee, particularly in the problems dealing with cooperation, leadership and personnel problems of the employees.

MR. JOSEPH LUKOWITZ, of Milwaukee, Wis., is in charge of a course in manual arts at the summer session of the Milwaukee State Teachers' College.

MR. E. W. MANZER, of Bronxville, N. Y., is teaching a course in art metal work at the summer session of the University of Wisconsin, Madison.

MR. J. HENRY HOLLOWAY has been appointed principal of the Central Printing Trades School, MR. E. V. NOSKA of the Central Building Trades School, and MR. M. C. RITTER of the Central Needle Trades School, in New York City.

MR. GEORGE C. DECKER, of Valley City, N. Dak., has been appointed supervisor of industrial arts in the Fairview High School, Dayton, Ohio. MISS RUBY STARR, of Racine, Wis., will take up her duties as supervisor of homemaking courses in the same school.

MR. R. L. COOLEY, director of the Milwaukee Vocational School, and MISS LITA BANE, of the University of Wisconsin, have been appointed as members of the new national advisory committee on education to study the relations of the Federal Government to education.

MR. E. G. LUDTKE, state supervisor of vocational education for Louisiana, has been elected president of the Louisiana Vocational Association. MISS RUTH O. BAKER, of New Orleans, was elected vice-president, and MISS VIOLET O'REILLY, of the same city, secretary-treasurer.

MISS BARBARA WRIGHT, supervisor of school counseling at Minneapolis, Minn., has been elected president of the Vocational Guidance Association, to succeed Homer Smith. Other officers elected were: MISS MATTIE HENRY, vice-president; MISS KATHERINE WOODRUFF, secretary-treasurer, and MR. J. E. PAINTER, chairman of the membership committee.

(Continued on Page 27a)

(Continued from Page 24a)

MR. ANDREW A. WINTERBAUER, of Spring Valley, Ill., has accepted a position in the high school and junior college at Harvey, Ill.

MR. HARVEY W. WAFFLE has been elected as instructor of drawing at Waukesha, Wis. Mr. Waffle had been reelected to serve another year at Plymouth.

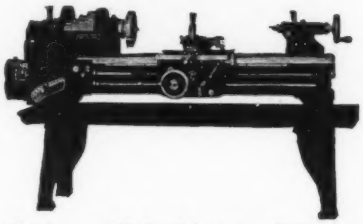
School Shop Equipment News

For the Supervisor and Teacher who desires to keep abreast with news of new Machinery, Tools, Supplies, etc.

NEW PORTER-CABLE TOOLROOM LATHE

The Porter-Cable Machine Company of Syracuse, N. Y., has announced the marketing of its new Precision toolroom lathe.

The lathe has been designed with the features of rigidity, durability, and convenience in mind. The headstock is of the box type, with side walls extending up to the center line of the spindle, making it especially efficient in resisting all strains tending to deflect the spindle bearings from true alignment. Sixteen speeds are provided with four-step cone and back gears and a two-speed countershaft.



The spindle is provided with taper journals, running in special bronze bearings, which are lubricated by oil rings. The tailstock has a long bearing on independent shears, to which it is clamped by a cam and conveniently placed lever. It is machined within such limits of measurement that it is interchangeable, and provided with side adjustments for maintaining alignment with the head spindle or to turn slight tapers. The apron is compact and strong, and is provided with a feed control, a thread dial for convenience, and a power cross-feed. The quick-change gear-box thread chart allows 47 different threads with standard gears.

The lathe is provided with a lead screw, a draw-in device, and a steady rest. A taper attachment and a relieving attachment can also be provided.

NEW OLIVER TILTING-ARBOR MOTOR-DRIVEN SAW BENCH

The new No. 191 Oliver tilting-arbor, motor-driven saw bench, just announced by the Oliver Machinery Co., of Grand Rapids, Mich., although smaller in size, is similar to the former saw bench placed on the market last year.

The saw is suitable for a variety of uses. It can be used in the crating department, in the cabinet department, in the

(Continued on Page 28a)

Irwins for SPEED

. . . . they bite; they cut; they spew out the chips . . . the hole is made.

Irwin Bits make holes cleaner, quicker, accurately. Your student craftsmen get the "feel" of good tools that stays with them all their useful lives when they start in with such tools as Irwin Bits.

When you insist on Irwin Bits for your shops you are starting these young men with a love of fine tools, good workmanship . . . a sense of the eternal fitness of things that will serve them well in years to come.

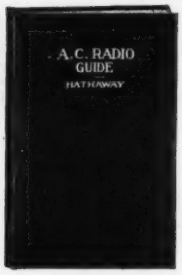
Have you had our special charts for the Industrial Arts instructor? And the booklet "How to select, use and care for Bits"? We would like to send them to you.

THE IRWIN AUGER BIT COMPANY
WILMINGTON, OHIO

Sole manufacturers of the Genuine

The IRWIN Bit
Reg. U.S. Pat. Off.

"A.C. RADIO GUIDE"



Just off the press! Written by Kenneth A. Hathaway, Radio Technical Advisor, The Chicago Daily News. Every page in this book is new—has never before been published. It deals exclusively with electrically operated radio sets.

Important details of several internationally known all-electric sets are explained and in a mighty clear and interesting, non-technical manner. The operation and construction of the new dynamic speakers are also fully explained. In every respect this book is well adapted for those schools in which the building and maintenance of the new electric types of sets form a part of their electrical instruction. Let us send you a copy for ON APPROVAL inspection. 121 pages. Size 5½" x 8½". Well illustrated. Red Cloth binding. Price $1.50.

BLUEPRINT READING

— For the Building Trades —

This is another splendid text which we have just published. Every page is new! Written by eminent authorities from the instruction point of view — J. Ralph Dalzell, Department of Architectural Engineering, American School; James McKinney, Educational Director, American School; Herman Ritow, Principal, Hayes School, Chicago.

The popular question and answer method is used in this text. First an important question is asked and then a complete answer is given with references to the plans themselves. It is an ideal text for all schools. Let us send it to you for ON APPROVAL examination. 107 pages. Size 5½" x 8½". Well illustrated. Durable red cloth binding. Price $1.25.

MECHANICAL DRAWING LESSON TEXTS

We have also published fourteen (14) new Lesson Texts dealing thoroughly with the subject of Mechanical Drawing. They have been especially prepared for school use and are exceptionally well illustrated. The titles of the texts follow: 1. Instruments and Materials; 2. Lettering; 3. Geometrical Definitions; 4. Geometrical Problems, Part 1; 5. Geometrical Problems, Part 2; 6. Symbols — Dimensions — Inking a Drawing; 7. Principles of the Working Drawing, Part 1—Projection Principles; 8. Principles of the Working Drawing, Part 2—Hidden Parts and Third View; 9. Principles of the Working Drawing, Part 3—Sections and Drawing to Scale; 10. Principles of the Working Drawing, Part 4 — Working Drawing and Rules of Projection; 11. Intersections; 12. Developments; 13. Isometric Projection; 14. Oblique Projection.

We will be pleased to send the entire series for ON APPROVAL examination, or, if you prefer, just those certain ones in which you are mainly interested. Size 7" x 10". Paper bindings. An average of 25 pages per text. $.25 each.

AMERICAN TECHNICAL SOCIETY

Dept. H. S. 12

Drexel Avenue at 58th Street, Chicago, Ill.

————[TEAR OFF HERE AND MAIL TO US]————

AMERICAN TECHNICAL SOCIETY
Drexel Ave. at 58th Street, Chicago, Dept. H. S. 12.

Please send the following texts for thirty (30) days ON APPROVAL examination. I will either return them within that time or else remit, less your educational discount. Also send folder describing your complete line.

.....

.....

Name.....

Address.....

Official Position.....

School.....

(Continued from Page 27a)

pattern shop, and is intended to save the time of the large machines. The table is stationary and level at all times. The saw tilts for angle-sawing and the angle of inclination is shown on a graduated scale at the front of the machine. There is a handy circular saw, with operating switch located on the front of the machine. The saw raises and lowers in making adjustments for the depth of the cut, which allows the table to be located at the natural working height at all times. The machine is ball-bearing, portable, and will cut 2 in. deep, with a standard 7 in. saw, or 2½ in. deep with an 8 in. saw. It will groove and dado and is adaptable for ripping, beading, for cutting tongue and groove, and for cutting compound miters, and tenoning. The machine is equipped with a standard one-half h.p. ball-bearing motor.

NEW STARRETT THICKNESS-GAGE STOCK

The L. S. Starrett Company of Athol, Mass., has announced a thickness gage or "feeler" stock in a new and convenient form, for production operations, where certain thicknesses are desired. The No. 666 Starrett thickness-gage stock comes in 25-ft. rolls, ½ in. wide, and in thicknesses from .0015 to .015 of an inch, packed in special metal cases.

STARRETT THICKNESS-GAGE STOCK

The gage stock is spring-tempered to insure accuracy and dependability and is marked every 6 in. with a line, permitting accurate cutting and elimination of waste. It has the advantage that in cases where the stock becomes bent or kinked, the damaged part may be quickly cut off. If this stock is used in the Starrett thickness holder, the last bit may be utilized and all injury to the fingers is eliminated. This feeler stock is useful for checking gear play, spark plugs, valve clearances, fitting pistons, or for any job where certain thicknesses, or clearances must be maintained.

A READY REFERENCE FILE FOR THE PRINTING DEPARTMENT

The Western States Envelope Company of Milwaukee, Wis., has just issued a handy reference file of samples of envelopes. The material will prove very helpful to the instructor of printing. It is a complete file for quick reference in case of necessity.

ATKINS COMPANY NOT MERGING

Mr. N. A. Gladding, general sales manager of E. C. Atkins Company, Inc., Indianapolis, Ind., has issued a statement, in which he states that his company has not merged with any other organization, nor does the company contemplate such action, regardless of rumors to that effect. The firm is working independently, with the same officers who have been in charge for many years.

NEW CATALOG OF STEEL STORAGE EQUIPMENT

The Berger Manufacturing Company, of Canton, Ohio, has issued its new Catalog No. 106, describing and illustrating its new advanced line of steel storage equipment.

The booklet describes and illustrates the firm's line of wedge-lock rack-type and bin-type steel selving, flexi-bilt units, angle-bilt display-type shelving, steel counters, display stand, table, and counter, angle-bilt storage shelving, factory

(Continued on Page 31a)

(Continued from Page 28a)

and shop specialties, lockers, office equipment, and wedge-lock shelving.

Complete information and prices concerning this line of storage equipment may be obtained upon request.

NEWS AND NOTES

Summer Vocational School for Ten Weeks

The board of education of St. Louis, Mo., has announced the opening of a summer term of ten weeks for vocational students. Regular vocational courses will be conducted in such subjects as industrial sewing and patternmaking, metal working, woodworking, automotive mechanics, and graphic arts.

Propose Vocational Course at Canton, Ohio

A definite vocational course is planned at Canton, Ohio, with the opening of the fall term. The courses are intended to supply the industrial needs of the Community.

Aviation Course at Syracuse, N. Y.

A course in aviation will be offered in the vocational High School, Syracuse, N. Y., with the opening of the fall term.

New Vocational School at St. Louis, Mo.

The school board of St. Louis, Mo., has completed plans for the erection of the new vocational school on the site of the old Central High School. The building will be erected in units, the first units to be used for vocational instruction and the correlated academic classes.

Furniture Made by Boys in New Orleans

An exhibit of the term's work in manual training was held recently at New Orleans, La. The work consisted of furniture projects made by a thousand boys in the sixth, seventh, and eighth grades. The exhibit was part of a furniture contest, at which prizes were awarded for simple and more advanced projects.

Teachers' Salaries

New York, N. Y. The board of education has taken steps for a readjustment of the salary schedule for instructors in the trade schools. Fifty teachers, about one quarter of the total group in the trade schools, are involved, and the cost of readjusting the salaries will reach $12,000,000. The changes in the schedule have been proposed as a result of an apparent discrimination in salaries which has destroyed the morale of the women industrial teachers in the vocational schools, and has in many cases driven them from the trade schools.

As a remedy for the situation, the board of superintendents has proposed that the salaries of these women teachers, which now range from $2,040 to $3,900 under schedule 3J, be made the same as those for teachers in vocational schools for boys, who now receive salaries ranging from $2,148 to $4,500 under schedule 3C. The changes will eliminate the difference between the compensation paid to industrial teachers in the girls' trade schools and that paid to teachers in the boys' trade schools.

Winners Announced for Chicago Model Airplane Meet

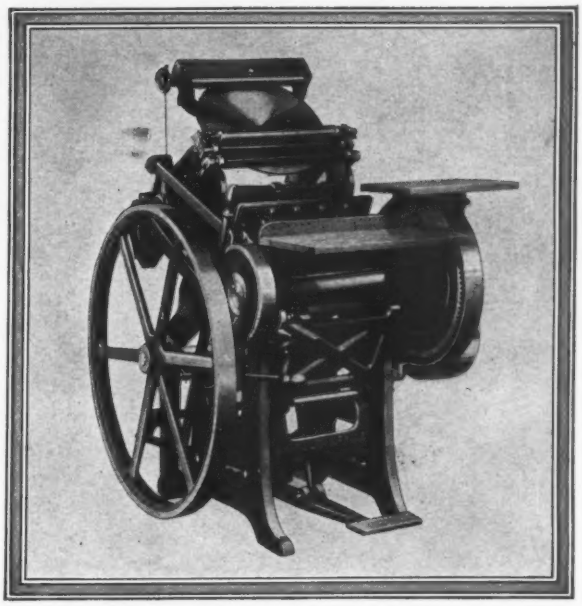
At the All Chicago Model Airplane tournament, held at the 132nd Infantry Armory, Chicago, recently, Carl V. Carlson and Henry Pacevitz were selected as the winners. As a result, the boys will represent their city at the national meet, to be held in Detroit, June 20. Carlson was a high-point contestant in the senior division for having won three seconds in the various events, and Pacevitz, in the junior division, finished first in the R. O. G. duration and sixth in the indoor track events.

At the tournament, trophies and 24 medals were awarded. The trophies to the organizations earning the greatest number of points in the class A and B divisions went to the Illinois Model Aeroplane Club and the south parks.

Aviation Classes at Seattle, Wash.

The school board of Seattle, Wash., has approved a recommendation of Supt. T. R. Cole, providing for the establishment of courses in aviation and power-machine operation. The first course will be for students in the upper grades of the high

(Continued on Page 32a)



. . . Boys Learn to Do *by Doing*

Boys don't learn to play basketball or any other game by sitting in a classroom, poring over text books, and answering examination questions. They learn to play by playing—to do by doing. If boys had to learn a game by studying and memorizing, there'd be fewer skilful players and much less good sportsmanship in the world, as well as less actual enjoyment in the playing of the game itself.

SEE OUR DATA IN BRUCE'S SPECIFICATION ANNUAL 1929 EDITION

THE game of life! It is mastered primarily through action. The qualities that guarantee success arise out of experience rather than textbooks.

Printing departments develop indispensable values in the adolescent boy—*through action.* They give him self-reliance, and acquaintance with the rudiments of machinery, an appreciation of the artistic and beautiful, a knowledge of design and color, an understanding of the service rendered to business and life by type-and-paper.

And one of the best features of all is that the boy takes on these values without resenting them as unmanly, because they come to him through his essential, native bent towards continuous physical activity and achievement.

Chandler & Price
PRESSES & PAPER CUTTERS

THE CHANDLER & PRICE COMPANY
Cleveland, Ohio, U. S. A.

✓ CHECK YOUR VOCATIONAL NEEDS WITH THIS SHELDON LIST

Mr. Vocational Director, it will pay you to check your vocational needs against the Sheldon list appearing below. Sheldon vocational furniture has been well known for over thirty years. The furniture is built so well that thousands of benches and tables installed thirty years ago are still giving good service. Check this list, then ask us to tell you in detail how we can meet your requirements.

- Benches for Woodworking
- Benches for the Electric Shop
- Benches for Auto Mechanics
- Benches for Home Mechanics
- Benches for the Machine Shop
- Benches for Sheet Metal Work
- Tool Cabinets
- Display Cases
- Mechanical Drawing Tables
- Rapid Acting Vises
- Continuous Screw Vises
- Parallel Bar Vises
- Steel Bar Clamps
- Concealed Tail Vises
- Quick Set Bench Stops

All Sheldon drawers are dovetailed. A five pound weight dropped 14 inches into an ordinary tenoned, grooved and nailed drawer broke the tenons and allowed the sides to be pulled out the fifty-seventh time it was dropped. Tested exactly the same way the weight was dropped 500 times into a Sheldon dovetailed drawer without the slightest damage.

E. H. SHELDON & CO., Muskegon, Mich.

30 Years Building Vocational Furniture

(Continued from Page 31a)

schools who have had two years of mathematics. The second will be for girls in the part-time school who are preparing to enter the industry.

Vocational Teacher Trainers as Supervisors

At a meeting in the state vocational division office of Indiana, plans were completed on June 4 for using the four teacher trainers in the industrial field as assistant supervisors.

Up to the present time, these men, who are in direct contact with the industrial teachers of the state, had no authority to make suggestions for changes in class management, arrangement of shop, or other points of interest to the local teacher.

Under the new plan, the state industrial supervisor will be in position to be of great assistance to directors and supervisors in the development of the work.

Propose New Trades School at Cincinnati, Ohio

A committee of three representing the mechanical industries of Cincinnati, recently presented to the school board of that city a proposition calling for the establishment of a trade school in order to shorten the apprentice period and to provide trained workmen for the local industrial plants. The committee offered to cooperate with the school board in the establishment of a course of study and the preparation of plans for a building to house the school. A site for the building was suggested and the board was urged to employ an architect to prepare plans and to supervise the construction of the building.

Prize Contest for Design of Gold Medal for First Trans-Atlantic Flight

The U. S. Navy Department has announced a contest for designs of a gold medal, to be issued to the naval personnel which made the first successful trans-Atlantic flight in the naval flying boat, NC–4, in May, 1919. The contest which closes August 2, 1929, offers an award of $1,000 to the successful contestant. The designs will be submitted by the bureau of navigation to a commission on fine arts, who will make the selection of the best design. After the selection has been made, the successful contestant must submit a plaster cast of the design showing each detail.

Foreign Material to be Gathered by Drawing Students

The mechanical-drawing classes of the Roosevelt Senior High School, Chicago, Ill., recently attempted to prove that they are not at all provincial, but that they can accept and assimilate ideas from all over the world. In order to facilitate these ideas, the students formed an international mechanical-drawing correspondence project.

The students have selected a student foreign committee, in charge of Joseph Lentes, with letters explaining the nature of the project sent to the consuls and ambassadors in the foreign countries.

Under the plan, it is the purpose to use the consuls as mediums in obtaining drawings of a mechanical and architectural nature. In this way, the students will learn the accomplishments and difficulties of the work in other countries.

Carpentry Boys Build Dormitories

The carpentry boys of the El Paso Vocational School, El Paso, Tex., have completed six dormitories and a mess hall for the R. O. T. C. Boys' Camp at Cloudcroft, N. Mex. The work was performed under the direction of Mr. John Woods and Mr. Fred Muerdter, instructors.

New Trade Courses at Ilion, N. Y.

The high school at Ilion, N. Y., has added new courses in electricity, general metal work, patternmaking, and molding to the work offered in the general shop and woodworking departments. Another course in factory study of invention, production, and salesmanship is offered in connection with the local industries. The vocational work is under the direction of Mr. F. D. Bradley, who has been in charge of the work for the past fourteen years.